

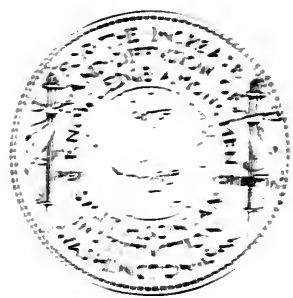


INTERNATIONAL CONFERENCE
ON THE STATE OF THE WORLD

PROCEEDINGS

UNITED STATES NATIONAL MUSEUM

VOLUME 11



THE NATIONAL MUSEUM
WASHINGTON, D. C.

ADVERTISEMENT

The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

The *Proceedings* series, begun in 1878, is intended primarily as a medium for the publication of original papers, based on the collections of the National Museum, that set forth newly acquired facts in biology, anthropology, and geology, with descriptions of new forms and revisions of limited groups. Copies of each paper, in pamphlet form, are distributed as published to libraries and scientific organizations and to specialists and others interested in the different subjects. The dates at which these separate papers are published are recorded in the table of contents of each of the volumes.

The present volume is the eighty-second of this series.

The series of *Bulletins*, the first of which was issued in 1875, contains separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens and special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

ALEXANDER WETMORE,
Assistant Secretary, Smithsonian Institution.

WASHINGTON, D.C., March 27, 1934.

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A REMARKABLE NEW GENUS AND SPECIES OF TWO-WINGED FLIES RELATED TO THE OESTRIDAE

By CHARLES H. T. TOWNSEND

Itaquaquecetuba, Sao Paulo, Brazil

Dr. J. M. Aldrich has asked me to name and describe an extremely interesting fly which he sent me for examination and which I believe to be the most important oestromuscoid discovery of the twentieth century from the taxonomic point of view.

After long deliberation, I arrived some years ago at the conclusion that the oestriiform tachinids or Tachino-Oestridae of Villeneuve (Aulacephalini, Ormiini, Trixodini, Trixini, Palpostomatini, Paratrixini, Glaurocarini, and Myiotrixini) all belong in the same family with the Oestrini, despite the apparent gap between the last-named tribe and all the others. There was no known form that would fit in the Oestrini better than in any of the other tribes and yet show some of the widely different characters of the latter, such as well-developed macrochaetae, developed haustellum, and ventral membrane concealed.

The present form closes this gap between the Oestrini and the other tribes of Oestridae above named. Its venation and head conformation are both strikingly oestrine and preclude its reference to any of the other tribes, yet the ventral membrane is concealed, the proboscis is considerably developed, and the bristles are well developed.

OLIGOOESTRUS, new genus

Genotype.—*Oligooestrus oestroideus*, new species.

Male.—Form moderately narrowed. Head (fig. 1) subelliptic in front view, roundly bulging below, about one-fourth wider than high, its profile subsenircular; frontal profile flat, well sloped, twice as long as facial profile to vibrissae; facio-oral profile arcuate; clypeus depressed, cuplike, a little longer than wide, no facial carina; epistoma nearly twice as long as clypeus, arcuately receding, somewhat over half as wide as clypeus, a little widened above and more below; facialia bare, half as wide as clypeus, obliquely flattened; vibrissae decussate, longer than the bristles below them; vibrissal

angles set high above lower border of head; 8 or 9 weaker and shorter bristles below vibrissae, 1 pair decussate; vibrissal area proper is glabrous, rather elongate, and narrowed, with few hairs outside peristomal row to mark its separation from cheek-grooves; vibrissal axis considerably shorter than antennal, latter about three-fourths head height; oral cavity shallow, rostrum recessive, haustellum as long as antennae, labella knoblike and nearly as long as haustellum, palpi only microstubs; antennae on eye middle, approximated at base, very small and short, first joint flush, second very short with 1 long bristle; third joint microseedlike, as long as second, basal half inserted in latter; arista little longer than antennae, scarcely longer than the bristle of second antennal joint, arising

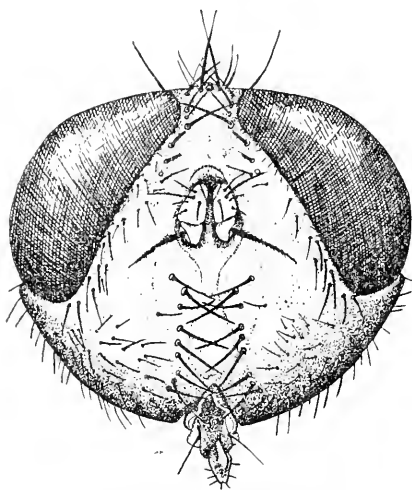


FIGURE 1.—*Oligooestrus oestroides*, new genus and species: Head of male from in front

from middle of third antennal joint, thickened only at base, short-pubescent, basal joints short; eyes bare, faintly oblique on lower part, reaching vibrissal level, facets equal; vertex one-sixth head width; front narrowed to one-seventh head width on middle, widening rapidly to one-half head width at base antennae; face widening rapidly from front, two-thirds head width at level of lower border of eyes; frontals stopping at base antennae, weak, anterior one stronger, 6 or 7 in all, not hugging frontalia; inner verticals straight, outer absent; no fronto-orbitals; frontalia considerably narrowed posteriorly, nearly three times as wide as one parafrontal, smooth; ocellar triangle reaching two-fifths of the way to lunula, triangular, filling vertex, longer than wide; only 2 ocelli, the front one absent; ocellars proclinate-erect, parallel, as long as anterior frontals; postocellars weak, erect; postverticals shorter than postocellars; parafrontalia setose, faintly sloped anteriorly; parafacialia equibroad, oblique to clypeal plane, as wide as clypeus plus both facialia, outer one-third to one-half with erect bristles, no facio-orbitals; cheek three-fourths the eye length; cheek grooves rather large, facing forward, with 3 long prongs; no geno-orbitals; occipital area invading most of cheeks, its vestiture fine like that of occiput.

Infrascutellum well developed; lateral postscutellar plates, squamopleura, prosternum, and propleura bare; prosternum moderately

wide, its membrane bare and not inflated; prescutum much shorter than postscutum; postalar wall, tympanic ridge, and pit bare; greater ampulla very small, seedlike, somewhat raised, convex, bare; 1 preacrostichal, the middle one; 1 postacrostichal, 2 presuturals, 3 postsuturals; 1 preintraalar, the front one; 2 postintraalars, 1 presupraalar, 1 postsupraalar, 3 humerals, 1 intrahumeral, no post-humeral, 2 postalars, no intrapostalar, 2 or 3 mesopleurals and many hairs below, one weak upper mesopleural, 1 mesopleural-spiracular, 1 propleural; 1 sternopleural, the front one; pteropleura with a few bristles in a bunch, 5 hypopleurals; 2 lateral scutellars, middle one lacking, hind one strong, no apicals.

Wings (fig. 2) little over twice as long as broad, wide on middle and narrowing at both base and tip, veins crowded into less than costal half; alulae rather large, erect, half as wide as long; costal spine quite strong, as long as small cross vein; remigium bare, its

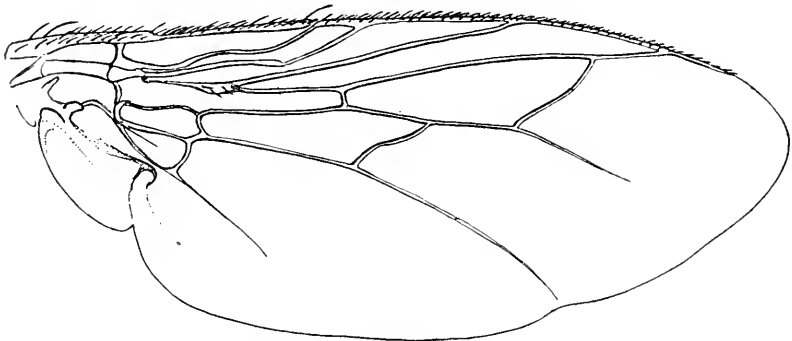


FIGURE 2.—*Oligoœstrus œstroideus*, new genus and species: Wing

inferior proximal process also bare; apical cell long-petiolate, the petiole as long as hind cross vein, in line with third vein and reaching margin nearly twice the length of hind cross vein before wing tip; first vein bare and terminating close beyond auxiliary vein; third vein with 2 microbristles at base; small cross vein short, straight, nearly on outer two-thirds of discal cell, opposite tip of hind cross vein, halfway between tips of auxiliary and first veins; apical cross vein sinuate, long stump and wrinkle at cubitus; latter angular, very obtuse, three-fifths wing width from hind margin; hind cross vein sinuate, midway between small cross vein and cubitus, nearly parallel with apical cross vein; fifth vein bare, its last section much longer than preceding section; squamae bare, nearly as wide as long, rounded on both outer and inner hind corners, somewhat projecting outside, squamae nearly one-fifth their area.

Legs not elongate, not stout, rather finely bristled, tarsi moderately long and all joints well bristled, front coxae little longer than hind

coxae; hind tibiae with three longer bristles and some short hairs, all the metatarsi much shorter than the following joints taken together; claws elongate, very slender and delicate, thickened on base.

Abdomen very short-ovate, rounded behind, somewhat flattened, little wider than thorax and same length, a little longer than wide; basal segment short, first sternite much wider than second; second to fourth sternites exposed, second longer than wide, all narrow, no membrane visible except narrowly at base of second sternite; no marginals on first segment, only a single pair of very short appressed median marginals on second segment, marginal row on third segment but only one median marginal pair erect, erect marginal row on fourth segment; first hypopygial tergite with marginal row and inferior aspect, second with same aspect but no marginal row; hypopygium ventral and rather large, lobes of fifth sternite moderately large and sternite set forward to near midventer.

OLIGOESTRUS OESTROIDEUS, new species

FIGURES 1, 2

Length of body, 5 mm; of wing, 4 mm. One male, Bariloche, Nahuel-Huapi Lake, Argentina, collected by Raymond C. Shannon.¹

Dusky, more or less silvery pollinose.

Head entirely yellow in ground color except the ocellar triangle and the upper half of the posterior surface, in which, however, the true occiput is yellow almost down to the neck; parafrontal and parafacial thin yellowish pollinose. Cheek shining and frontal stripe rather deep yellow without perceptible pollen. The space inside the lunule below is shining with a dark translucent appearance. Thorax, abdomen, and legs black; tip of scutellum distinctly yellow. Mesonotum with rather dense tessellated brownish-yellow pollen, the stripes changing greatly with the angle of view. Dorsum of abdomen rather evenly and thinly covered with gray pollen, somewhat denser on fourth segment. Wings gray; squamae white including rim.

Type.—Male, U.S.N.M. No. 43802.

¹ Mr. Shannon collected three specimens of this fly on the same date; only one was sent to Doctor Townsend, which becomes the type; one is retained by Mr. Shannon; the third is to be deposited in the British Museum. All are males.

The drawings for the two figures herein were made by Mrs. Eleanor Carlin, through the kindness of the Bureau of Entomology.—J. M. ALDRICH.

A NEW PALEOCENE MAMMAL FROM A DEEP WELL IN LOUISIANA

By GEORGE GAYLORD SIMPSON

American Museum of Natural History, New York City

The discovery here described is one of the most remarkable in the history of vertebrate paleontology. A core was unintentionally taken in an oil well in Louisiana at a depth of 2,460 feet, and apparently from this core came the fairly well-preserved facial and palatal part of a small skull. As if this in itself were not sufficiently improbable, the skull, although supposed to be of Cretaceous age, proves to be that of a Paleocene mammal of a genus hitherto known only from very limited areas in New Mexico and Montana. This noteworthy specimen has been assigned to me for study through the kindness of C. W. Gilmore.

The circumstances of the discovery are given as follows by W. C. Spooner in a letter to Dr. W. C. Mendenhall dated March 14, 1931:

In reply to your letter of March 3d concerning core from the Junior Oil Company Beard No. 1, Caddo Parish, Louisiana.

The condition of the well, at the time the sample containing the specimen was obtained, was such that I am unable to state positively that it came from the depth reported. Surface casing was set through the Wilcox formation into the Midway Clay with open hole below the depth from which the specimen was obtained. The drill-stem had parted at a depth of 2,460 feet and the drillers were running an overshot-fishing-tool, attempting to pick up the drill-stem. The overshot was a piece of pipe shaped as shown in the sketch.

The drill was leaning against the wall of the hole and when the overshot was lowered it hit the drill-stem on the side, deflecting it into the wall of the hole opposite the side against which the pipe leaned, so that when the overshot was rotated it cored into the wall of the hole at the depth reported. Inasmuch as they failed to place the overshot over the drill-pipe, it was pulled out of the hole and the material cored from the wall was removed. This material was definitely the same material as shown in the cores from this depth and, according to the drillers and the drilling-superintendent, who was on the well at the time, the concretions were imbedded in the shale, which was a core although taken under unusual circumstances. Unfortunately, the core was broken before I had an opportunity to examine it and am unable to state whether the men at the well are correct in their assumption that the specimen belonged in the material cored.

It is possible that it may have come from the Midway above, although under the existing conditions it is rather difficult to see how it could have lodged in the position from which it was obtained. It would be much more reasonable to assume that if it had come from higher in the hole it would have

dropped below the top of the drill-stem, as the drill-stem was 4 inches in diameter, whereas the hole was 9 inches in diameter, and, furthermore, the drill-stem was leaning against the side wall of the hole.

However, there is a distinct element of uncertainty as to the actual depth from which the specimen was obtained, but I am certain that it came from beds older than the Wilcox formation.

Some further data are given in a memorandum from H. D. Miser to Dr. J. B. Reeside:

* * * Core from the Junior Oil Company Beard No. 1 well in sec. 9, T. 18 N., R. 16 W., Caddo Parish, Louisiana, at a depth of 2,460 feet. According to Mr. Spooner, the formation from which the core was taken is the Tokio formation of Austin age.

Although thus considered as probably coming from Cretaceous strata, the specimen is surely of Paleocene age, and probably not earliest Paleocene, as will be shown below. Speculation as to the possibility that the terrestrial mammal-bearing Paleocene is in part equivalent to the marine late Cretaceous is not furthered by this find. It is not certain that the specimen was in place at the recorded depth, although this seems very probable, and it is apparently not certain that the stratum in question does not belong to a post-Cretaceous intercalation not present, or not recognized, in surface exposures of adjacent regions. The latter would seem the most probable hypothesis on the data at hand.

Description of the specimen follows:

Order AMBLYPODA

Family PERIPTYCHIDAE

Subfamily ANISONCHINAE

ANISONCHUS FORTUNATUS, new species

Type specimen.—U.S.N.M. No. 12147. Anterior part of skull, with left canine, broken P³ of both sides, somewhat imperfect M¹⁻³ of both sides, and other tooth fragments.

Type locality.—Junior Oil Company Beard No. 1 well, sec. 9, T. 18 N., R. 16 W., Caddo Parish, La.

Horizon.—From an oil well, probably at a depth of 2,460 feet. Formation uncertain, but evidently (from the specimen itself) of Paleocene and probably of Torrejon age.

*Definition*¹.—Size of molars about that of *A. sectorius*, premolar series relatively smaller and shorter. Molar proportions also about

¹This definition is so expressed as to facilitate comparison with revised diagnoses of other species of the genus in the still unpublished memoir of the Paleocene mammals of the San Juan Basin by Matthew and Granger.

as in *A. sectorius*, more triangular than in that species but less transverse than in *A. gillianus*. Base of hypocone projecting much farther internally than base of protocone. Hypocones, especially that of M^3 , relatively stronger than in other species. Trigons, proper, strongly compressed transversely. Anterointernal cingulum (protostyle) very weak or absent. Small metaconules on all molars, protoconules very weak or (probably) absent on M^{2-3} . Paracone and metacone well separated, paracone larger than metacone, slightly

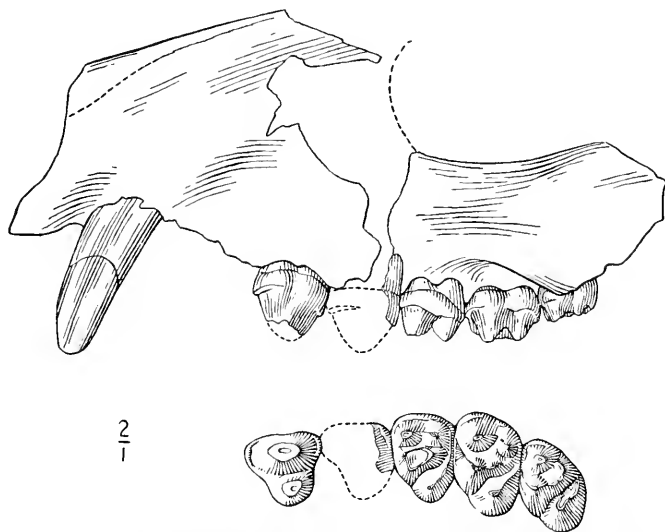


FIGURE 1.—*Anisonchus fortunatus*, new species, type specimen, U.S.N.M. No. 12147. Left lateral view of face, with canine and P^2 - M^3 , and crown view of left P^2 - M^3 . Teeth in part a composition from both sides of original

on M^{1-2} , more so on M^3 . P^3 trigonal, wider than long, strong internal heel.

Measurements.— M^{1-3} about 13.5 mm. Posterior edge of canine to posterior end of M^3 about 30 mm.

Remarks.—The diagnosis, in conjunction with what is known of the San Juan Basin species, gives an adequate conception of the known morphology of the cheek teeth. The canine is relatively large and laniary, the incisors apparently small and unspecialized. The snout was pointed, the nasals long and narrow. The very stout zygoma arises chiefly outside and above M^2 . The anterior border of the orbit is above the anterior end of M^1 . The general aspect of the facial part of the skull is that of a small and primitive carnivore.

This specimen fortunately preserves characters diagnostic of the genus *Anisonchus*: P^3 with laterally compressed external cusp and well-developed internal cusp, upper premolars in general enlarged

but not molariform, upper molars low-crowned, basically tri-tubercular but with large posterointernal heel, cusps high and sharp, protostyle small or absent, molars less transverse than in *Conacodon* or *Haploconus*.² It is not closer to any other genus and differs no more from other species referred to *Anisonchus* than they differ between themselves. In short, surprising as is the discovery of an *Anisonchus* at this place and level, the generic reference is not open to question.

Two valid species of *Anisonchus* have previously been established: *A. gillianus* from the Puerco, and *A. sectorius* (the type) from the Torrejon. The genus also occurs in the Fort Union, but the species there present have not yet been defined or identified. *A. gillianus* and *A. sectorius* are very distinct, and *A. fortunatus* is also a very clear-cut species. In part it combines characters of the other two. Thus the strong internal projection of the hypocone base and the shape and proportions of the premolars are more like *A. gillianus*, while the molar size and overall proportions, separation of paracone and metacone, and reduction of protostyle are more like *A. sectorius*. Other characters, such as the very large hypocones and extreme compression of trigons, are distinctive from either species. The combination of these various characters is unique.

Being about equally distinct from *A. gillianus* and *A. sectorius* its closer affinities are in doubt. It is perhaps in a stage of evolution analogous to that of *A. sectorius* but derived independently from a more primitive, more *A. gillianus*-like common ancestry.

The age of the specimen is surely Paleocene. Other specimens of this genus are known only from the Lower and Middle Paleocene, and *A. fortunatus* is not apparently more advanced than those from the latter. More exactly, but with somewhat less security, it seems to be of approximately Middle Paleocene, Torrejon age.

The discovery of mammal-bearing Paleocene sediments nearly half a mile below the surface in Louisiana (and far below sea level) is a very extraordinary and interesting fact, but unfortunately it can hardly be said to open up a new field for collecting.

² Absence of conules is sometimes given as characteristic of *Anisonchus* or the *Anisonchinae*, but the less-worn specimens of both San Juan Basin species of *Anisonchus* show small but distinct conules, although less developed than in the present specimen.

THE CHINESE LIZARDS OF THE GENUS GEKKO

By LEONHARD STEJNEGER

Head Curator, Department of Biology, United States National Museum

The recent accession of material by the National Museum has helped clear up several doubtful points in the taxonomy and distribution of the lizards belonging to the genus *Gekko*, so that a summary of our present knowledge of this interesting group may not be out of place.

Genus GEKKO Laurenti

1768. *Gekko* LAURENTI, Syn. Rept., p. 43 (type, *G. verticillatus* Laurenti=*Lacerta gekko* Linnaeus).
1792. *Stellio* SCHNEIDER, Amph. Physiol., vol. 2, p. 2 (type, *S. gekko*; not of Laurenti).
1800. *Gekko* CUVIER, Leçons d'Anat. Comp., vol. 1, tabl. III (emendation).
1810. *Gecus* RAFINESQUE, Caratteri, p. 9 (emendation).
1817. *Ascalabotes* CUVIER, Règne Animal, vol. 2, p. 44 (subst. for *Stellio* Schneider).
1817. *Platydactylus* OKEN, Isis, 1817, p. 1183 (based on "Platy-Dactyles" Cuvier, 1817; type designated in 1843 by Fitzinger, *G. guttatus* Daudin).
1833. *Somatodactylus* VAN DER HOEVEN, Handb. Dierk., vol. 2, pt. 2, p. 342 (type, *G. vittatus* Houttuyn).
1843. *Scelotretus* FITZINGER, Syst. Rept., p. 101 (type, *G. vittatus*).

KEY TO CHINESE SPECIES AND SUBSPECIES OF GEKKO

- a*¹. Rostral not entering nostril.....gecko
*a*². Rostral entering nostril.
*b*¹. No web at base of toes, or a mere trace.
*c*¹. Dorsal tubercles numerous, usually more or less evenly distributed on the back to and often invading occiput.
*d*¹. On each side of base of tail normally 2 or 3 tubercles close together, or a cluster of smaller tubercles (occasionally only one large).....japonicus
*d*². On each side of base of tail normally a single large tubercle.....japonicus hokouensis
*c*². Dorsal tubercles less numerous, especially on the anterior half of the back and rarely invading occiput.....swinhonis
*b*². A distinct web at base of toes.
*c*¹. Back without tubercles; male with 9 to 11 preanal pores.
*d*¹. Back grayish, uniform or with obscure dark markings or cross bands.....subpalmatus
*d*². Back with distinct dark, broad cross bands.....subpalmatus melli
*c*². Back with numerous small tubercles; males with 17 or more preanal pores in one row.....chinensis

GEKKO GECKO (Linnaeus)

1758. *Lacerta gecko* LINNAEUS, Syst. Nat., ed. 10, vol. 1, p. 205 (type locality, "in Indies").—*Gekko gecko* BARBOUR, Mem. Mus. Comp. Zool., vol. 44, 1902, p. 82.—*Gecko gecko* MELL, Grundz. Oekol. Chines. Rept., 1929, p. 11 (Indo-malayan).—AHL, Sitz. Ber. Ges. Naturf. Freunde, Berlin, 1929 (1930), p. 327 (Kiangsi).
1768. *Gekko verticillatus* LAURENTI, Syn. Rept., p. 44 (based on "Seba, I. 108. 2 & 6 & 7").—GEE, Peking Soc. Nat. Hist. Bull., vol. 4, pt. 2, 1929, p. 57 (Kwangtung, Kwangsi).—*Gecko verticillatus* BOULENGER, Cat. Liz. Brit. Mus., vol. 1, 1885, p. 183 (southern China, etc.).—BOETTGER, Offenbach. Ver. Naturk., 24-25 Ber., 1885, pp. 117, 140 (Canton; Kwangsi); 26-28 Ber., 1888, p. 61 (Canton).—WERNER, Abh. Bayer. Akad. Wiss., Kl. 2, vol. 22, pt. 2, 1903, p. 360.—STANLEY, Journ. North China Asiat. Soc., vol. 45, 1914, p. 25 (southernmost China).—VOGT, Sitz. Ber. Ges. Naturf. Freunde, Berlin, 1914, p. 97 (Wu-tzung, near Canton).—MELL, Arch. Naturg., vol. 88, sect. A, pt. 10, Dec., 1922, p. 111 (Kwangtung; Lolong; Lofausan; Ding-wu-sau; Tseberg, north distr.)
1768. *Gekko teres* LAURENTI, Syn. Rept., p. 44 (based on "Seba, I, 108. 1 & 3").
1803. *Gecko guttatus* DAUDIN, Hist. Nat. Rept., vol. 4, p. 122, pl. 49 (type locality unknown).—GÜNTHER, Rept. Brit. India, 1864, p. 102 (southern China).—*Platydaactylus guttatus* DUMÉRIL and BIBRON, Erp. Gén., vol. 3, 18, p. 328, pl. 28, fig. 4 (India; Java; Timor; Manila, Philippine Islands).
1820. *Gekko versus* MERREM, Tent. Syst. Amph., p. 42 (in "Archipelago Indico"; based on "Seba Thes. I. t. 108").
1820. *Gecko annulatus* KUHL, Beitr. Zool. vergl. Anat., pt. 1, p. 132 (type locality unknown).
1831. *Gekko reevesii* GRAY, in Griffith, The animal kingdom, vol. 9, Syn., p. 48 (type locality [Canton] China; type in Brit. Mus., J. Reeves, collector).—*Platydaactylus reevesii* FITZINGER, Syst. Rept., 1843, p. 101 (China).
1858. *Gekko indicus* GIRARD, Herp. U. S. Expl. Exped., p. 290, pl. 16, figs. 9-16 (type locality, Mangsi Isl., Philippine Islands; type U.S.N.M. No. 5681).
1927. *Gekko gekko* SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 54, p. 479 (Yunnan-fu? or Tonkin) (emendation).—GEE, Peking Soc. Nat. Hist. Bull., vol. 4, pt. 2, 1929, p. 57 (Yunnan; Tonkin).

The locality Yunnan-fu for this species seems extremely doubtful, as admitted by Schmidt. The United States National Museum has no specimen from Chinese territory. It seems to be confined to Kwangsi and Kwangtung, and has not even been recorded for Hainan.

GEKKO JAPONICUS (Duméril and Bibron)

1836. *Platydaactylus japonicus* DUMÉRIL and BIBRON, Erp. Gén., vol. 3, p. 337 (type locality, Japan; types in Paris Mus.).—*Gecko japonicus* GÜNTHER, Rept. Brit. India, 1864, p. 103 (southern Japan; China; Formosa).—BOULENGER, Cat. Liz. Brit. Mus., vol. 1. 1885, p. 188 (Japan; China: Chefu, Shanghai, Ningpo, etc.); vol. 3. 1887, p. 488 (Ichang, China; Riukiu Archipelago).—BOETTGER, Ber. Senckenberg. Naturf. Ges., 1894, p. 143 (Shanghai).—WERNER, Abh. Bayer. Akad. Wiss., Kl. 2, 1903, p. 300 (China).—ELPATIEWSKY and SABANEJEV, Zool. Jahrb. Syst., vol. 24, 1906, p. 250, pl. 18, fig. 1 (Bakhti Sv. Olgi i Sv. Vladimira, Ussuri, probably introduced).—NIKOLSKI, Fauna Rossij, Rept., vol. 1, 1915, p. 93 (part:

- Japan; Chefu).—*Gekko japonicus* STEJNEGER, Journ. Sci. Coll. Tokyo, vol. 12, pt. 3, p. 218 (Formosa); Herpet. Japan, 1907, p. 165, pl. 13 (Japan, Korea, China); Proc. U. S. Nat. Mus., vol. 66, art. 25, 1925, p. 37 (Kiangyin, Kiangsu; Hankow; Hunan).—VAN DENBURGH, Proc. California Acad. Sci. ser. 4, vol. 3, Dec. 16, 1912, p. 106 (Shanghai, Formosa; Riukiu).—JACOT, China Journ. Sci. Arts, vol. 1, 1923, p. 259 (Chefoo); Peking Nat. Hist. Bull., vol. 5, pt. 3, 1931, p. 42 (Shansi: Kolan; Shantung).—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 54, 1927, p. 477 (Fukien, Anhwei, Hunan).—GEE, Peking Nat. Hist. Soc. Bull., vol. 4, pt. 2, Dec., 1929, p. 57 (part).
1838. *Platydaetylus jamori* TEMMINCK and SCHLEGEL, Fauna Japon., Rept., p. 103 (type locality, southern Japan; types in Leyden Mus.; Siebold, collector).
1842. *Hemidaetylus nanus* CANTOR, Ann. Nat. Hist., vol. 9, Aug., 1842, p. 482 (Chusan).
1891. *Platydaetylus jamori* FRITZE, Mitth. Deutsch. Ges. Ost-Asiens, vol. 5, p. 239 (emendation).
1902. *Gehyra intermedia* BROWN, Proc. Acad. Nat. Sci. Philadelphia, June 11, 1902, p. 183 (type locality, probably Okinawa Shima, Riukiu; type, Wistar Inst. No. 572; Furness and Keller, collectors).

A number of specimens from Shanghai (U.S.N.M. Nos. 67035-38 and 73188) add little to our knowledge of this form. Their dorsal lepidosis is normal; the male (No. 67035) has eight preanal pores in a continuous row, and three well-developed basicaudal tubercles. The young, No. 73188, has also three small such tubercles; in the others they are represented by clusters of smaller tubercles.

GEKKO JAPONICUS HOKOUENSIS Pope

1928. *Gekko japonicus hokouensis* POPE, Amer. Mus. Nov., no. 325, Sept. 15, 1928, p. 1 (type locality, Hok'ou [Hokow], northeast Kiangsi, China; type, Amer. Mus. Nat. Hist. No. 35090; C. H. Pope, collector); Bull. Amer. Mus. Nat. Hist., vol. 58, p. 365, fig. 1 (northeast Kiangsi; Chungansien, Fukien).—GEE, Peking Soc. Nat. Hist. Bull., vol. 4, pt. 2, Dec., 1929, p. 57.

This form has been separated from *G. japonicus* on the strength of the large single tubercular scale at the base of the tail. In 13 topotypes recorded by Mr. Pope it was single on both sides; in the fourteenth specimen it was divided on one side.

By referring to my Herpetology of Japan, p. 168, it will be seen that this feature is subject to great variation in true *G. japonicus*, even in Japan, where specimens with large single tubercles are not uncommon. However, in most of the specimens, both in Japan and on the mainland, especially in the lowlands of the lower Yangtse Basin, the number ranges from 1, 2, or 3 larger tubercles to clusters of smaller tubercles, as attested by 12 specimens in the National Museum, from the Kiangsu, Hupeh, and other Provinces.

The type material of the present form comes from a plateau on the boundary between Fukien and Kiangsi. The Museum of Com-

parative Zoölogy has a large series of specimens from Tunglu, about 165 miles to the northeast in the neighboring Province of Chekiang, collected by J. T. Wright. Thanks to the kindness of Dr. Thomas Barbour, 10 of these are in the National Museum (Nos. 78193-202), and in every one of them the tubercle is single and large, somewhat of the shape of the "shovel" on the metatarsal tubercle of certain toads. In some of the specimens there is evidence of its origin in a consolidation of three smaller tubercles.¹ These specimens from Chekiang are otherwise identical with the average Yangtse basin specimens, except that perhaps more specimens of the former show a tendency toward the dorsal tubercles being less numerous on the middle of the back than in the former. Similar specimens occur also in our series from Japan and Korea. As a consequence I am unable to distinguish these Kiangsi-Chekiang specimens with a single basicaudal tubercle from a number of Japanese and Chinese specimens of typical *G. japonicus*. Nevertheless, in view of the large number of individuals in the region where the three Provinces of Kiangsi, Fukien, and Chekiang meet, displaying this character, I consider it expedient to recognize this form trinominally at least until further researches shall have evaluated the importance of this character. I am the more inclined toward this procedure by a consideration of the fact that in all our specimens of *G. subpalmatus* the tubercle in question is large and single.

Owing to the comparative nearness of Chusan, the type locality of Cantor's *Hemidactylus nanus* (Ann. Nat. Hist., vol. 9, Aug., 1842, p. 482), I requested Mr. Parker to examine the type in the British Museum with regard to the basicaudal tubercles, and he kindly informs me that there are three on each side of the base of the tail. The name therefore seems to be an unconditional synonym of *G. japonicus*, as represented by the Shanghai specimens, and does not interfere with the nomenclature of the form here considered.

GEKKO SWINHONIS Günther

1864. *Gecko swinhonis* GÜNTHER, Rept. Brit. India, p. 104, pl. 12, fig. A (type locality, Peking, China; type in Brit. Mus.; R. Swinhoe, collector).—BOULENGER, Cat. Liz. Brit. Mus., vol. 1, 1885, p. 189 (Peking).—MÜLLER, Verh. Naturf. Ges. Basel, vol. 7, pt. 3, 1885, p. 709 (Tientsin).—*Gecko swinhonis* STEJNEGER, Herpet. Japan, 1907, p. 166 (northern China); Proc. U. S. Nat. Mus., vol. 66, art. 25, 1925, p. 36 (Chili; Kansu; Shensi; Shantung; Tientsin to Peking).—BARBOUR, Proc. New England Zoöl. Club, vol.

¹Dr. Thomas Barbour has kindly examined the remaining series of 25 specimens in the Museum of Comparative Zoölogy. He summarizes the result as follows: "I would define the Tunglu lot as characterized by having, in the adult males, invariably a single, elongate, shovel-shaped tubercle derived from the coalescence of two rudiments which occasionally persist as independent papillae in young specimens and of these larger in females than in males."

- 4, Nov., 1909, p. 61 (Sian, Shensi).—VAN DENBURGH, Proc. California Acad. Sci., ser. 4, vol. 3, Dec. 16, 1912, p. 207 (Chefu).—JACOT, China Journ. Sci. Arts, vol. 1, 1923, p. 259 (Shantung); Peking Nat. Hist. Bull., vol. 5, pt. 3, 1931, p. 42 (Tsinan, Shantung, in the hills).—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 54, 1927, p. 1927, p. 478 (Chihli; Shansi).—POPE, Bull. Amer. Mus. Nat. Hist., vol. 57, 1929, p. 368 (Chili; Shansi).—GEE, Peking Soc. Nat. Hist. Bull., vol. 4, pt. 2, 1929, p. 57 (North China; Chihli; Shansi).
1885. *Gekko swinhoei* BOETTGER, Offenbach. Ver. Naturk., 24-25 Ber., p. 139; 26-28 Ber., 1888; p. 61 (Miau-feng-shan, near Peking); Kat. Rept. Mus. Senckenberg, vol. 1, 1893, p. 35.—WERNER, Abh. Bayer. Akad. Wiss., Kl. 2, vol. 22, pt. 2, 1903, p. 360.
1887. *Gekko japonicus* MOELLENDORF, Journ. North China Asiat. Soc., new ser., vol. 11, p. 104 (Chili) (not of Duméril and Bibron).—SOWERBY, in Clark and Sowerby, Through Shen-Kan, 1912, p. 111 (Kansu; Shensi).

A series of 27 specimens collected by F. R. Wulsin for the National Geographic Society (U.S.N.M. Nos. 628210-26) at Peking agrees with those previously recorded. The males have 7 to 9 preanal pores, mostly 9, in an uninterrupted series. The basicaudal tubercles are usually 2 or 3, mostly 3, on each side or, less often, clusters of smaller tubercles.

GEKKO SUBPALMATUS Günther

1864. *Gekko subpalmatus* GÜNTHER, Rept. India, p. 104, pl. 12, fig. B (type locality, "Chikiang," China; type in Brit. Mus.; Robert Fortune, collector).—BOULENGER, Cat. Liz. Brit. Mus., vol. 1, 1885, p. 189 (Chikiang); Proc. Zool. Soc. London, 1899, p. 160 (Kuatun, Fukien).—BOETTGER, Offenbach. Ver. Naturk., 24-25 Ber., 1885, p. 139 (Chikiang); 26-28 Ber., 1888, p. 116 (Tschekiang).—WERNER, Abh. Bayer. Akad. Wiss., Kl. 2, vol. 22, pt. 2, 1903, p. 360.—*Gekko subpalmatus* STEJNEGER, Proc. U. S. Nat. Mus., vol. 66, art. 25, 1925, p. 35 (part: Suifu, Szechwan).—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 54, 1927, p. 478 (Yenping, Fukien; Wanhsien, Szechwan).—POPE, Bull. Amer. Mus. Nat. Hist., vol. 58, 1929, p. 367 (Yenping and Ch'ungau Hsien, Fukien).—GEE, Peking Soc. Nat. Hist. Bull., vol. 4, pt. 2, 1929, p. 57 (Chekiang, Fukien, Szechwan).

The locality given for the type of *G. subpalmatus* is "Chikiang, China," and the collector's name "Mr. Fortune." The latter is undoubtedly the celebrated traveler Robert Fortune, who in the later forties and early fifties of the nineteenth century made several visits to the tea districts of eastern China, collecting plants and information regarding the tea industry.

Definite localities for this form have not been established outside the Provinces of Fukien and Szechwan, and when specimens from the latter were first received it was surmised that the locality "Chikiang" referred to some place in that Province. However, it appears certain that Mr. Fortune did not reach Szechwan, nor even Chikiang in Hupeh, about 80 miles south of Ichang. Most of his travels in what was then called "northern China" were in the tea

districts of Ningpo and other places of the Province of Chekiang. It has therefore been generally supposed that "Chikiang" was an error for Chekiang. While there is no definite record of any specimen having as yet been taken in that Province, it is, of course, not excluded that it may occur in the higher mountain districts of the interior near the western frontier. As a matter of fact, Mr. Fortune in the summer of 1849 undertook a voyage to the "Bohea Mountains" (Wuyi shan) in Fukien, which took him through the whole length of Chekiang into the mountain region where Chekiang, Kiangsi, and Fukien meet.² Among other places he stopped at Ch'ungan Hsien, Fukien (or Tsong-gan-hien, as he spells it), where Mr. Pope 76 years later obtained two specimens of this same form.³ Most likely, therefore, it was in this very mountainous region, which extends across the boundary into Chekiang, that the type specimen of *G. subpalmatus* was collected.

This seems to be the only form occurring in the region about Suifu, Szechwan, from which locality Dr. D. C. Graham has recently sent additional specimens (U.S.N.M. Nos. 67571, 69467, 76586, and 76589). Like those previously received, they are quite typical, with no dorsal tubercles, and a single large tubercle on each side of the base of the tail. The fingers are distinctly webbed at the base as well as the toes, a feature particularly well shown in No. 76589.

GEKKO SUBPALMATUS MELLI (Vogt)

1922. *Gecko melli* Vogt, Arch. Naturg., vol. 88, sect. A, pt. 10, p. 136, pl. 4, fig. 2 (type locality, mountains of northeastern Kwangtung, 500-800 meters altitude).—MELL, Arch. Naturg., vol. 88, sect. A, pt. 10, p. 111.—*Gecko melli* GEE, Peking Soc. Nat. Hist. Bull., vol. 4, pt. 2, 1929, p. 57 (Kwangtung).

The *Gecko melli* from Kwangtung, described in 1922 by Doctor Vogt, does not seem to differ materially from *G. subpalmatus* except perhaps in the intensity of the broad dark bands across the back, which, if constant, may justify the subspecific appellation *Gecko subpalmatus melli* (Vogt).

GEKKO CHINENSIS Gray

1842. *Gecko chinensis* GRAY, Zool. Misc., p. 57 (type locality, China; type in Brit. Mus.; J. Reeves, coll.).

1885. *Gecko japonicus* BOETTGER, Offenbach. Ver. Naturk., 24-25 Ber., p. 117 (environs of Canton, China) (not of Duméril and Bibron); 26-28 Ber., 1888, p. 60 (Ding-her-shan, Kwantung).

1923. *Gecko similignum* SMITH, Journ. Nat. Hist. Soc. Siam, vol. 6, Oct. 31, 1923, p. 198 (type locality, Ang-mao, 600 meters altitude, near Five Finger Mountain, Hainan; type in Brit. Mus.; Malcolm Smith, coll.).—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 54, 1927, p. 461 (Hainan).

² Two visits to the tea countries of China, ed. 3, vol. 2, pp. 125-273. London, 1853.

³ Bull. Amer. Mus. Nat. Hist., vol. 58, 1929, p. 367.

1925. *Gekko subpalmatus*? STEJNEGER, Proc. U. S. Nat. Mus., vol. 66, art. 25, p. 36 (part: Foochow, Fukien; U. S. N. M. No. 65379; A. de C. Sowerby, collector) (not of Günther).
1929. *Gekko semilignum* GEE, Peking Soc. Nat. Hist. Bull., vol. 4, pt. 2, p. 57 (emendation; Hainan).

In my previous paper⁴ I referred to a specimen in the National Museum (No. 65379) as follows:

Among Sowerby's Fukien material there is also a gecko collected by him at Foochow. As far as the web of the feet is concerned, it is a typical *G. subpalmatus*, but the back is regularly covered with small though distinct tubercles, and the median chin shields are rather well developed. * * * I am therefore strongly inclined to the belief that the tubercles of the Sowerby specimen are the result of admixture of *G. japonicus* blood.

Since writing the above, Malcolm Smith's description of his new species from Hainan came to hand, and apparently my suggestion of the hybrid origin of the Fukien specimen became negatived, since the latter agrees point for point with the description of Malcolm Smith's specimen. *Gekko similignum* is characterized by having the back with about 10 irregularly disposed longitudinal rows of enlarged, rounded tubercle; the fingers one-third webbed, toes a little more; 17 preanal pores; 12 to 14 lamellae under fourth finger and a single large tubercle on either side of the base of the tail.

The Foochow specimen has a web between the fingers at their base, though not so conspicuous as that between the toes, agreeing in both respects with *G. semipalmatus*. Whether the fingers may be characterized as "one-third webbed" is perhaps doubtful, but such comparisons are quite vague, and a more definite description impracticable. It has 23 preanal pores in a continuous series; 13 lamellae under fourth fingers and toes; the tubercles on the back can hardly be said to form series, but there are about 10 in a line across the sides and back; the tubercle at the base of the tail is large and single as in *G. subpalmatus*.

The combination of tubercles on back with webbing between fingers and toes, and the high number of preanal pores, which normally varies between 4 and 11 in the other Chinese geckos of the same genus, seemed to indicate that we had to do with a distinct form, extending from Hainan north into Fukien. The relationships to *G. palmatus* from Tonking may not be made clear until a male of the latter is obtained.

Recalling that Boettger, in 1885 and 1888, had recorded two specimens from Kwangtung under the name of *Gecko japonicus*, but with 22 and 19 preanal pores, respectively, while the normal number of pores in that species varies between 4 and 11, and also that the type of Gray's *Gecko chinensis* in the British Museum was based

⁴ Proc. U. S. Nat. Mus., vol. 66, art. 25, 1925, p. 36.

on a specimen collected by J. Reeves probably near the same city, I sent our Fukien specimen to Dr. H. L. Parker and asked him to compare it with the types of *G. chinensis* and *G. similignum*. He very obligingly did so and wrote me as follows:

I have compared [U.S.N.M.] 65379 with the type of *G. chinensis* and *G. similignum* and I have very little doubt that the three are conspecific; Mr. Smith has seen them and agrees. Whether or not this represents a species distinct from *G. japonicus* I would not care to decide offhand. On the face of our material it appears so, but quite possibly they are only races of the same thing.

It may thus be regarded as established that there exists in southern China, from southern Fukien to Hainan, a distinct form characterized by the large number of 17 to 23 preanal pores (No. 65379=23; Boettger's specimens=22 and 19; type of *chinensis*=21; type of *similignum*=17) besides the more extensive webbing of fingers and toes, as compared with the 4 to 11 pores, and more vestigial webbing in typical *G. japonicus*.

DESCRIPTION OF A TICK, *DERMACENTOR HALLI*, FROM THE TEXAS PECCARY, WITH A KEY TO THE NORTH AMERICAN SPECIES OF *DERMACENTOR*

By ALLEN McINTOSH

Assistant Zoologist, Zoological Division, Bureau of Animal Industry, United States Department of Agriculture

Among a collection of parasites made on September 3, 1931, by Dr. Maurice C. Hall, chief of the zoological division of the United States Bureau of Animal Industry, were several ticks taken from five collared peccaries, also known in Texas as javelinas, which were shot on the King Ranch, Kingsville, Tex. The ticks were turned over to the writer for identification, and were found to represent the following species: *Amblyomma cajennense*, *Dermacentor variabilis*, and a species of *Dermacentor* regarded by the writer as new.¹

DERMACENTOR HALLI McIntosh, 1931

Male: Body oval (fig. 1, *a*), narrowing anteriorly, broadest at coxae IV: 4.38 mm long (capitulum not included): 2.8 mm wide. Scutum (pl. 1, fig. 1) reddish brown, fading to yellowish brown in the mesal region posterior to pseudoscutum, with an extensive pattern of white rust. The white consists of a narrow border along the lateral margins beginning somewhat posterior to the eyes and encircling the festoons: along the mesal border of each lateral groove is a faint trace of white: beginning near the apex of each scapular angle is a *broad white stripe* extending on each side to the first and second festoons.

These two stripes, the most conspicuous of the white markings, run almost parallel to about the center of the scutum, where, after a slight convergence, they diverge in their course to the festoons. Beginning near the inner border of each cervical groove is a narrow stripe of white: these two stripes soon unite and expand as irregular broken patches of white over the postero-central portion of the pseudoscutum: the two stripes are reformed and continue posteriorly in a slightly diverging direction to anastomose as a rule, although in some specimens the union may be broken, with the *broad white stripe*

¹An abstract of this paper was published in the Proceedings of the Seventh Annual Meeting of the American Society of Parasitologists, Journ. Parasit., vol. 18, no. 2, p. 124, Dec., 1931.

of each side at about the middle of the scutum. Posterior to this point and between the *broad white stripes* are 4 narrow white stripes extending to the festoons: the inner 2 of the 4 are usually united anteriorly with each other: posteriorly they are united with each lateral member of the group: each lateral member is connected anteriorly with the *broad white stripe* of each side. The continuity of the white is often broken by minute punctations and small irregular patches of brown. In areas where no rust is present the pigmentation of the ceca is visible as irregular black lines. Pseudoscutum not well defined, brown with irregular patches of white rust as mentioned above: capitular emargination 200μ deep by 650μ wide: cervical grooves short, moderately deep depressions, not extending to level of eyes: marginal grooves narrow and shallow, marked by a row of 10 to 14 medium-sized punctures: also a row of punctures

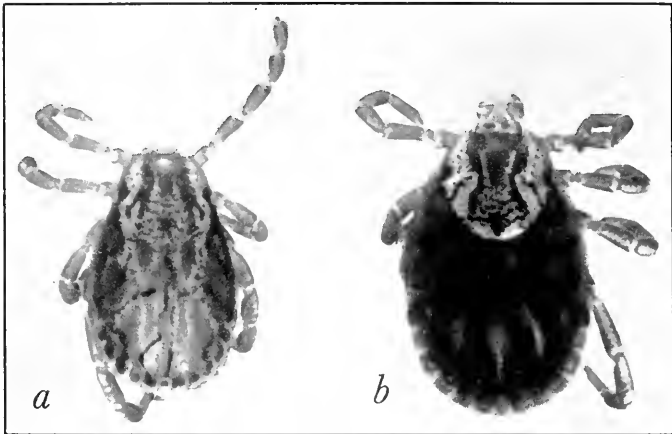


FIGURE 1.—*Dermacentor halli*: a, Male; b, female. (Enlarged $8\frac{1}{2}$ times)

on each lateral margin, and a few scattered ones in the scapular region between the eye and the cervical groove. Over the remainder of the scutum is a conspicuous absence of the deep punctures so characteristic in some species of the genus *Dermacentor*. Eleven well-defined festoons, the outer ones broader than the inner: the posterior margin of each is of a lighter brown, and each is marked dorsally with irregular patches of white and with one to three small punctures. Venter hairy, with numerous small and a few scattered medium-sized punctures: the region posterior to and between the coxae of each side much lighter in color than coxae and festoons. Genital orifice on level with coxae II: genital grooves about parallel to the level of coxae IV, where they converge slightly, then diverge sharply and extend to the posterior margin of the body to unite with the groove between festoons 2 and 3: postanal median groove extends to median festoon. Stigmal plates (pl. 1, fig. 2) elliptical with a

broad posterodorsal prolongation; greatest dimension of plate, measured from anteroventral angle to tip of posterodorsal prolongation, 570μ ; maximum breadth, taken perpendicular to the above measurement, 340μ ; with a well-developed chitinized frame, broadest on each side of posterodorsal prolongation; macula elliptical, broadest at middle, 240μ long; aperture large; goblets numerous, approximately 100, of medium size, larger than in *D. variabilis*, with smaller granules near margin and on prolongation. Legs (pl. 1, figs. 3-5) ornate dorsally, with small punctations and bristles. Coxa I (pl. 1, fig. 6) with two well-developed spurs approximately equal in length, the sharply pointed external spur almost parallel to and well separated from the broad internal spur. Coxae II, III, and IV each with a short well-developed external spur; the internal spur on coxa II marked by a sharp-edged salient ridge; this morphologic feature is less pronounced on coxa III, and there is no indication of an internal spur on coxa IV. Femur IV armed ventrally with five to six teeth, a strong bristle arising at the base of and distal to each tooth; femurs I, II, and III without teeth but with bristles on ventral surface. Tibia and metatarsus of leg IV also provided ventrally with bristles and toothlike elevations; similar bristles are present on the other legs, but the elevations are less conspicuous, decreasing in prominence anteriorly. All tarsi with a ventroterminal tooth, another tooth immediately proximal to the terminal one; on tarsus I these two teeth are smaller and more widely spaced; proximal to the subterminal tooth are two or three elevations that are less prominent than the teeth; bristles present on all tarsi. Capitulum (pl. 1, fig. 7) 750μ long (mediodorsal measurement from tip of hypostome to edge of emargination); its base 570μ wide, with whitish markings dorsally; cornua long and pointed; hypostome dentition consists of three rows on each side with eight to nine teeth in each row; palps 470μ long, hairy, short, and broad, with white markings dorsally, and with articles II and III each about 230μ long; article I with 4 to 5 bristles on internal ventral edge, article II with 5 to 7, and article III with 2 to 3 such bristles.

Female: When flat and unengorged (fig. 1, *b*), 4.52 mm long and 2.85 mm wide; when engorged 9 mm long by 5.5 mm wide by 3 mm thick; newly emerged female 4.19 mm by 2.14 mm. Body hairy, brownish red, with white on shield, capitulum, and legs; marginal grooves and festoons distinct. Scutum (pl. 1, fig. 8) oval, broadly rounded from the eyes to the apex, and 1.79 mm long by 1.95 mm wide; brownish red with conspicuous white markings, the white consisting of a broad stripe beginning on each side near the apex of the scapular angle and continuing to the apex of the scutum where the stripes unite with each other; on the mesal margin of each cervical groove is a narrow white stripe, these stripes well separated at

first but converging near the center of the scutum, after which the white is much broken up by brown spots; the narrow stripes connect posteriorly with the broad stripe of each side; in some specimens the white is broken by a large brown spot near the apex of the scutum, in which cases the two narrow stripes of white are connected by a narrow bridge of white in front of the brown spot. The eyes are light brown, bounded on their mesal border by a dark-brown spot, which continues as a brown stripe along the margin of the shield. Cervical grooves short, forming deep lunules anteriorly; fine punctations as in the male, a few scattered deep punctures bearing a fine bristle in each lateral area. Fovea about 69μ in diameter, 299μ apart, and located 506μ from apex of scutum. Venter with punctations and hairs inconspicuous; genital orifice of unengorged females between coxae II, vulva of engorged females on level with interspace of coxae I and II; genital grooves slightly converging immediately posterior to vulva, then diverging gently until they have passed beyond the level of coxa IV; at the latter point they diverge at a wide angle as they extend to the festoons, uniting with the grooves between festoons 2 and 3. Spiracle (pl. 1, fig. 9) oval with a fairly broad posterodorsal prolongation; 515μ long, 400μ wide; goblets as in male; macula broad, oval, 280μ by 160μ . Legs pubescent, ornate dorsally; coxa I with spines as in male; femur and tibia IV not marked with spinelike teeth as in male; tarsi similar to male. Capitulum (pl. 1, fig. 10) 730μ long, 680μ wide at base, and marked with white; porose areas 160μ by 115μ , oval, diverging anteriorly and spaced about half their width apart; cornua rounded laterally, ending in a bladelike spine. Palps similar to males with from 5 to 6 bristles on internal ventral edge of article I, from 5 to 8 on article II, and 3 such bristles on article III.

Holotype.—Male, U.S.N.M. Helm. Coll. No. 31500.

Allotype.—Female, U.S.N.M. Helm. Coll. No. 31501.

Paratypes.—Three males and one female, U.S.N.M. Helm. Coll. No. 31502, and four males and two females, U.S.N.M. Arachnida Coll. No. 1047.

Type host.—*Pecari angulatus angulatus* (Cope).

Type locality.—Kingsville, Tex.

Remarks.—Of the 12 specimens collected, 8 are males and 4 are females; 2 of the females are engorged and 2 are unengorged. One of the unengorged females is apparently newly emerged. The specimens vary somewhat in size in both sexes, as may be observed from the shield measurements given in Table 1.

The following combination of characters will aid in separating *D. halli* from the other species of *Dermaacentor* described from America: (a) The characteristic color pattern of the shield; (b) the absence of numerous deep large punctations; (c) the equal length

of the well-separated spurs of coxa I; (d) the broad posterodorsal prolongation of the stigmal plate; and (e) the broad, posteriorly rounded shield of the female.

TABLE 1.—Shield measurements of eight male and four female specimens of *Dermacentor halli*

Males				Females	
Length	Width	Length	Width	Length	Width
<i>Mm</i>	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>
4.5	2.9	3.8	2.45	² 1.79	² 1.95
4.38	2.8	3.8	2.38	³ 1.77	³ 1.77
4.09	2.61	3.76	2.38	³ 1.7	³ 1.65
3.85	2.8	¹ 3.66	¹ 2.14	⁴ 1.67	⁴ 1.56

¹ Slightly deformed. ² Flat, unengorged. ³ Engorged. ⁴ Newly emerged.

The species of the genus *Dermacentor* reported from North America may be distinguished with the aid of the following key:

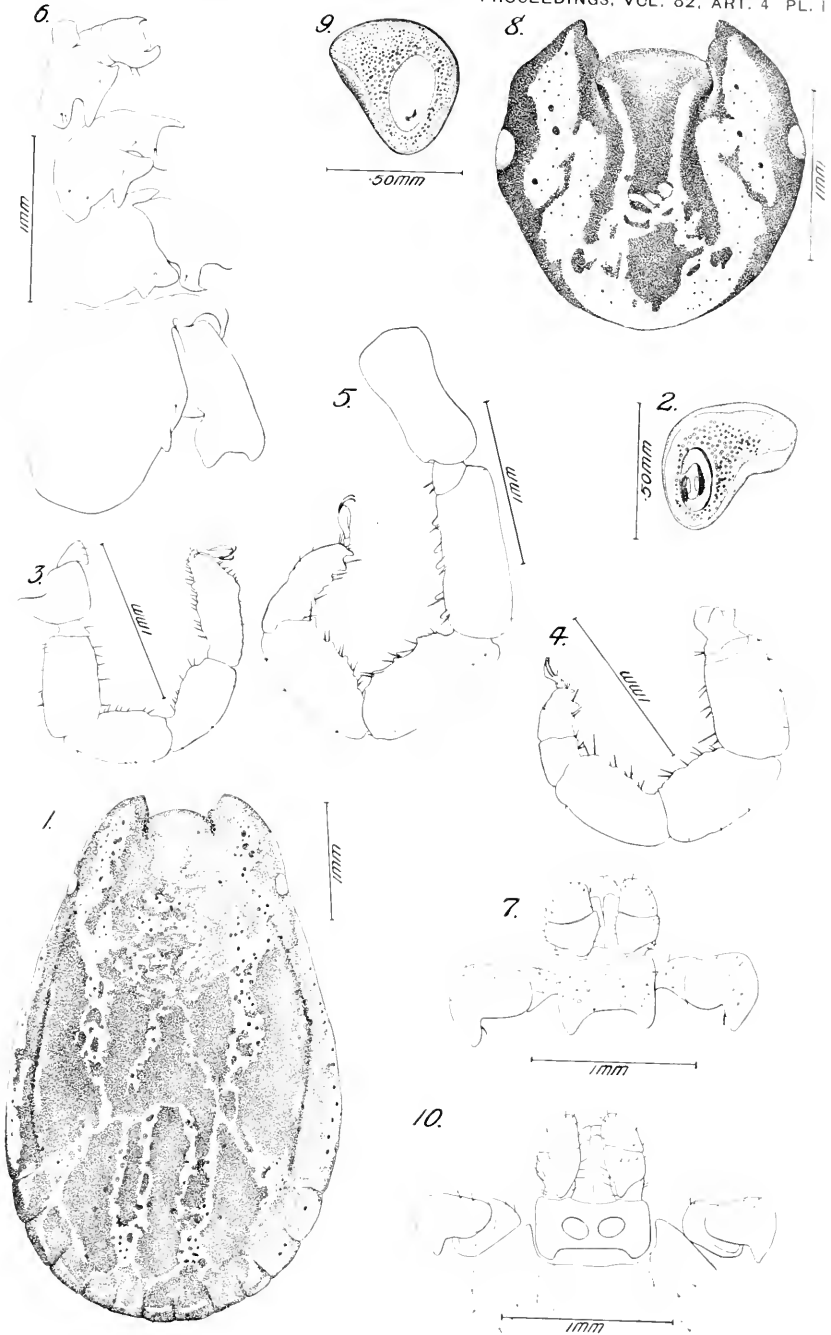
KEY TO THE NORTH AMERICAN SPECIES OF THE GENUS *DERMACENTOR*

1. Stigmal plate without distinct dorsal prolongation..... 2
Stigmal plate with distinct dorsal prolongation..... 4
2. Shield conspicuously marked with white..... *albipictus*²
Shield without white rust, or with very little white..... 3
3. Stigmal plate with only few (usually 4 to 10) large isolated goblets; males with only 8 impressed lines behind; no white on shield; spurs of coxa I widely separated..... *nitens*
Stigmal plate with many, more crowded, medium-sized goblets; males with 12 impressed lines behind; shield usually without white; spurs of coxa I close together..... *nigrolineatus*
4. Spurs of coxa I of equal length..... 5
Spurs of coxa I of unequal length..... 7
5. Spurs of coxa I widely separated; shield with mostly small shallow punctations; stigmal plate with broad dorsal prolongation..... *halli*
Spurs of coxa I close together; shield with many deep large punctations..... 6
6. Cornua of medium length; stigmal plate with minute goblets, and short, broad dorsal prolongation; white on male shield arranged more or less in longitudinal stripes..... *variabilis*
Cornua extra long, especially in male; stigmal plate with medium-sized goblets and well-developed dorsal prolongation; white on male shield uniformly diffused, broken by small brown spots and by numerous deep punctations..... *occidentalis*
7. Internal spur of coxa I slightly longer than external spur; cornua well developed; shield with mostly small punctations; stigmal plate with comparatively few goblets and narrow dorsal prolongation especially long and narrow in male..... *hunteri*

² *D. salmoni* Stiles, 1910, will key out with *D. albipictus*.

- External spur of coxa I usually slightly longer than internal spur; cornua of moderate length; shield with numerous large deep punctations 8
8. Spurs of coxa I parallel and close together; shield well marked with white; pseudoscutum of male outlined with white *andersoni* ♀
- Spurs of coxa I divergent, and well separated at least near the tips; shield with little or no white 9
9. Shield with no white *parumapertus*
- Shield of female marked with white at apex; male shield with from 1 to 4 small irregular spots of white along each lateral groove *parumapertus* var. *marginatus*

D. venustus and *D. modestus* Banks, 1909, will key out with *D. andersoni*.



DERMACENTOR HALLI

1. Scutum of male; 2. right stigmal plate of male; 3. right leg I of male; 4. left leg III of male; 5. left leg IV of male; 6. left coxae of male; 7. capitulum of male; 8. scutum of female; 9. left stigmal plate of female; 10. capitulum of female.

NEW FOSSIL FRESH-WATER MOLLUSKS FROM ECUADOR

By WILLIAM B. MARSHALL

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and

EDGAR O. BOWLES

George Washington University, Washington, D. C.

Specimens of fossil fresh-water mollusks recently received from Dr. George Sheppard, Geologo del Estado, Republica del Ecuador, yield three new genera, each represented by one new species, and a new species of *Pomacea*. They were collected by Doctor Sheppard in the vicinity of the towns of Biblian and Paccha, Ecuador. Until recently both these towns were in the Province of Canar, in southern Ecuador. A recent change in provincial boundaries leaves Biblian in Canar but places Paccha in the adjoining province, Azuay. The junior author has supplied the following data referring to the two localities, which lie on the watershed between the Atlantic and the Pacific:

Biblian lies a few miles northeast of the provincial capital, Azogues, and a little southeast of the city of Canar. It is located on the northwest bank of a small river, tributary of the Rio Paute, the waters of which, by way of the Rio Santiago and the Rio Maranon, reach the Amazon in western Brazil. About 7 or 8 miles north, and coming from some distance east, is a tributary of the Rio Canar, which flows into the Rio Naranjal of the Pacific drainage. Between the Naranjal and the Paute is a range of mountains, approximately 12,140 feet in altitude. Azogues, but a mile or two downstream from Biblian, has an altitude of about 8,200 feet, indicating a rapidly descending river, probably with high banks.

Paccha, now in the Province of Azuay, is a much smaller town, considerably south of Biblian and lying between the Rio Paute and a tributary, the Rio Quingeo. It is situated in a high valley, surrounded by hills, except on the side toward the Rio Paute, which here flows in an east-northeast direction. Southwest, toward the Rio Quingeo, is a high pass, but most of the surrounding country is less than 10,830 feet in altitude. Cuenca, on the Rio Matadero, a western

tributary of the Rio Paute, is the nearest large town, about 4 or 5 miles to the west. The Rio Matadero rises in the Cajas lakes, on the divide, probably the extreme western reach of the Atlantic drainage system in southern Ecuador, and perhaps in all South America. These are the nearest lakes of the Atlantic system, and consist of a number of large bodies of water in lofty valleys in the passes of Cajas. To the southwest are many small rivers, tributaries of the larger coastal rivers of the Pacific drainage.¹

At present there are no reliable data to establish the age of the deposits, but as none of the species and none of the genera except *Pomacea* occur in the recent fauna, it is probable that the age can not be later than Pliocene, and it may be earlier.

The formation is exclusively of fresh-water origin, as all the species found require a fresh-water habitat. In a former paper the senior author (Marshall, 1928) described and discussed several new genera and species of pearly fresh-water mussels from Pebas, Peru. Other authors had already described from that formation various land, fresh-water, and brackish-water shells, and a few which are doubtfully classed as marine. The land shells must, of course, have been washed in from the countryside.

Pebas is about 325 feet above sea level. Biblian is at least 8,000 feet above the sea and by air-line is only about 450 nautical miles from Pebas, although by the tortuous rivers it may be twice that far. The occurrence of fresh-water, brackish-water, and marine (?) species at Pebas suggests the possibility that formerly the locality was occupied by an estuary in which the brackish-water and marine species found a natural habitat. The inner reaches of the estuary may have been suitable for fresh-water species, just as is the case with the Rio de la Plata, in which very fine specimens of fresh-water mussels are found living, especially along the shores of Colonia. It is possible also that the species were washed down from fresh waters of higher levels. Investigation of the region between Pebas and Biblian may yield other fresh-water deposits, which will explain the mixed fossil molluscan fauna found at Pebas. As the fossil fresh-water species found at Biblian and Pebas seem to be of the same geologic age and as the two localities lie on the same stream, it appears likely that there is an intimate geological relationship existing between the two places. The presence of *Pomacea* in the deposit at Biblian may indicate a quiet-water habitat, as the recent species of the genus delight in placid waters.

¹Most of the above notes were obtained from charts and relief models owned by the Pan American Union. An instructive map of the watershed of Ecuador was published recently by Edward W. Berry (1929, p. 80).

The material filling the shells and molds of the fresh-water mussels and the mold of *Pomacea* (*Ampullaria*) is a light-gray calcareous sandstone. The surface of these specimens is yellowish brown, owing to a ferruginous-clay stain. The matrix of the *Sheppardiconcha* and the *Potamolithoides* is the same calcareous sandstone mentioned above, but the surface is grayish white, with little of the ferruginous stain. The grayish sandstone in the single valves of the mussels contains fossils and imprints of the shells of *Sheppardiconcha*, which, when they occur thus, are lightly coated with the ferruginous stain.

SHEPPARDICONCHA, new genus

Fresh-water gastropod mollusks with turritelliform spire, roundish aperture, which apparently is somewhat produced at the columellar side.

Type species.—*Sheppardiconcha bibliana*, new species, described in this paper.

Remarks.—This genus differs from *Hemisinus* Swainson in the turritellalike spire and in the rounded aperture. In *Hemisinus* the aperture is elongate and has a distinct anterior canal, making some of the species, notably the type, *Hemisinus lineolatus* Wood, resemble a very elongate *Planaxis*. *Hemisinus tuberculiferus* Conrad is not a *Hemisinus*, but belongs in *Sheppardiconcha*. *Hemisinus steeri* Conrad is apparently properly placed in the genus *Hemisinus*.

SHEPPARDICONCHA BIBLIANA, new species

PLATE 1, FIGURE 6

Shell turritelliform, imperforate, whorls numerous, slowly increasing in size, somewhat flattened. Longitudinal sculpture consisting of sinuous, slightly protractive incremental striae. Spiral sculpture of five strong, obscurely nodulous lirae on the surface of the whorls of the spire and one sunk in the suture. The upper lira and the one just above the suture a little stronger than the others and forming between them a deep channel marking the suture. Base worn but showing the remains of several lirae. Aperture roundish, columella curving forward.

Type.—U.S.N.M. No. 372837 measures: Length (upper whorls missing), 20 mm; diameter, 8.5 mm. It and a number of paratypes (U.S.N.M. No. 372838) come from Biblian, Province of Canar, Ecuador. U.S.N.M. No. 372839 includes a large number of specimens from Paccha, Province of Azuay.

Remarks.—The striking features of this species are the turritella-like form, the deeply channeled sutures, and the spiral lirae. It is related to "*Hemisinus*" *tuberculiferus* Conrad, of the Pebas group

in the Upper Amazon region of Peru, and that species also probably belongs in *Sheppardiconcha*. The species attains a much larger size than that of the type. A fragment consisting of little more than a single whorl has a diameter of 13 mm.

POTAMOLITHOIDES, new genus

Shell small, resembling *Potamolithus* but with spire depressed and base widely umbilicate or deeply excavate.

Type species.—*Potamolithoides biblianus*, new species, described in this paper.

POTAMOLITHOIDES BIBLIANUS, new species

PLATE 1, FIGURES 1-3

Shell small, somewhat beehive form. Apical whorls depressed, planorbiform, the embryonic whorl slightly sunken. Whorls rapidly increasing, flattish on the upper surface, body whorl large, subangular at the periphery, sutures linear. Base flat, widely umbilicate (or deeply excavate). Aperture oblique, outer lip thin, basal lip sinuate. Parietal wall with a thick, upstanding callus which makes the peritreme continuous.

Type.—U.S.N.M. No. 372840 measures: Height, 3.5 mm; greater diameter, 5 mm. It and many paratypes (U.S.N.M. No. 372841) come from Biblian, Province of Canar, Ecuador. The largest paratype measures: Height, 5 mm; greater diameter, 7 mm.

Remarks.—This is a fresh-water mollusk. Among recent shells its nearest relative seems to be *Potamolithus*, of which many species occur in the La Plata drainage, Uruguay, and southeastern Brazil. It may belong in the family Amnicolidae.

Genus POMACEA Perry

POMACEA BIBLIANA, new species

PLATE 1, FIGURES 4, 5

A mold showing that the shell had a depressed, nearly flat spire, rapidly increasing whorls, and ample body whorl which formed two-thirds of the whole shell, and a wide umbilicus. (The subangular periphery in front of the aperture is probably due to the whorl having been subject to pressure.)

Type.—U.S.N.M. No. 372842 measures: Height, 20 mm; greatest diameter, 30 mm. It comes from Biblian, Province of Canar, Ecuador.

Remarks.—There is no doubt that this is a *Pomacea* (until recently better known as *Ampullaria*) and therefore of fresh-water origin. While only a mold it is deemed worthy of description, as it affords additional evidence that the formation was derived exclusively from fresh-water deposits.

ECUADOREA, new genus

Fossil pearly fresh-water mussels of the subfamily Hyrianae² with plentiful radial sculpture similar to that of *Diplodon* and still more similar to that of *Hyria*. The radial ribs are arranged in a V pattern, each V nesting in a succeeding one. Posterior dorsal area with several plicae crossing it obliquely to the margin.

Type species.—*Ecuadorea bibliana*, new species, described in this paper.

Remarks.—It is difficult to decide the relationships of this genus to recent genera. Like *Prodiplodon* Marshall, from which it differs mainly in the flutings on the posterior dorsal area, it stands midway between *Hyria* Lamarck and *Diplodon* Spix. Its sculpture is more like that of *Hyria*, but it lacks the anterior clawlike projection, the symphynote posterior wing, and the very oblique appearance caused by the anterior end being very narrow while the posterior end is very broad. Several species of *Hyria* have somewhat similar flutings on the posterior dorsal area. In form the shell is more like *Diplodon*, but that genus is not so plentifully sculptured.

ECUADOREA BIBLIANA, new species

PLATE 1, FIGURES 7, 8

Shell rather compressed, subelliptic, slightly narrower in front. Concentric sculpture of fine growth striae, with a few of the rest periods a little accentuated. Radial sculpture of a number of riblets so arranged as to form a series of V's, each nesting into the succeeding one, and with other riblets at the front and back which if continued would form additional V's. The anterior prong of each V is narrow, clear-cut, and nearly straight. The posterior prong is heavier and more irregular and curves toward the front end of the shell. At the lower end where the radial sculpture dies out the surface is somewhat pimpled. The posterior dorsal area with several (five or six) distinct cordlike flutings running across it to the margin. The dorsal and ventral margins both arcuate.

Type.—U.S.N.M. No. 372843 measures: Length, approximately 33 mm; height, 24 mm; diameter, about 11 mm. It and a paratype (U.S.N.M. No. 372844) come from Biblian, Province of Canar, Ecuador.

Remarks.—In sculpture this species closely resembles *Ostalia pazi* Hidalgo, of the Province of Imbabura, Ecuador, which, however, does not have flutings on the posterior dorsal area.

² Simpson places this subfamily in the Unionidae, while Ortmann places it in the Mutelidae. The latter will probably prove correct, but can not be accepted until the supposed *lasidium* embryo of the latter is proved a mistake. See Marshall, Proc. U. S. Nat. Mus., vol. 79, art. 23, p. 12, 1931.

Genus ANODONTITES (?) Bruguière

U.S.N.M. No. 372845 includes a number of casts from Biblical that evidently were made in pearly fresh-water mussel shells. A few of them show remains of the shell on the surface. These fragments seem to have had a rather thick prismatic layer, which leads to the belief that the species belongs to the genus *Anodontites*, as a thick prismatic layer is one of the features of that genus. In most of the specimens one valve has slipped toward the ventral margin so that its beak is beneath the beak of the other valve. This slipping likewise may indicate the genus *Anodontites*, which has no teeth of any kind to serve to hold the two valves in place. The hinges of other fresh-water mussels of the region have pseudocardinal and lateral teeth, the former serving to direct the valves when the shell is closing and both helping to hold the valves in position when closed. As the teeth in one valve interlock with those of the other, force enough to break the teeth is necessary to make the valves slip.

NOTE ON DISTRIBUTION OF RECENT NAIADES

The great majority of recent South American naiades are found in the Atlantic drainage. On the Pacific side of the Andes almost none occur north of Chile. *Diplodon atratus* (Sowerby)³ has been reported from Peru. *Castalia crosseana* Hidalgo⁴ and *Diplodon pazi* (Hidalgo)⁵ were described as coming from the Province of Imbabura, Ecuador, which lies almost wholly in the Pacific drainage, although it seems probable that some small streams in its eastern part may drain into the Atlantic. *Castalia crosseana* is unrelated to any form found in the Pacific drainage, and it is of interest that its nearest relative is *Castalia linki* (Marshall)⁶ of the River Sinu, Colombia, Caribbean drainage. *Diplodon pazi* has no relative in the Pacific drainage, but many in the Atlantic.

The beak sculpture of all naiades on the Pacific side of the Andes is much reduced, consisting of a few radial bars, which occupy a small area at the beaks. The sculpture of many genera and species in the Atlantic drainage is bold, often occupying a large area. In some specimens of *Hyria rugosissima* Sowerby, a large species, the sculpture covers nearly the whole shell.

³ *Unio atratus* Sowerby, 1839. Conchological manual, fig. 148.

⁴ *Castalia crosseana* Hidalgo, 1865. Journ. Conchyl., p. 316, pl. 14, fig. 2.

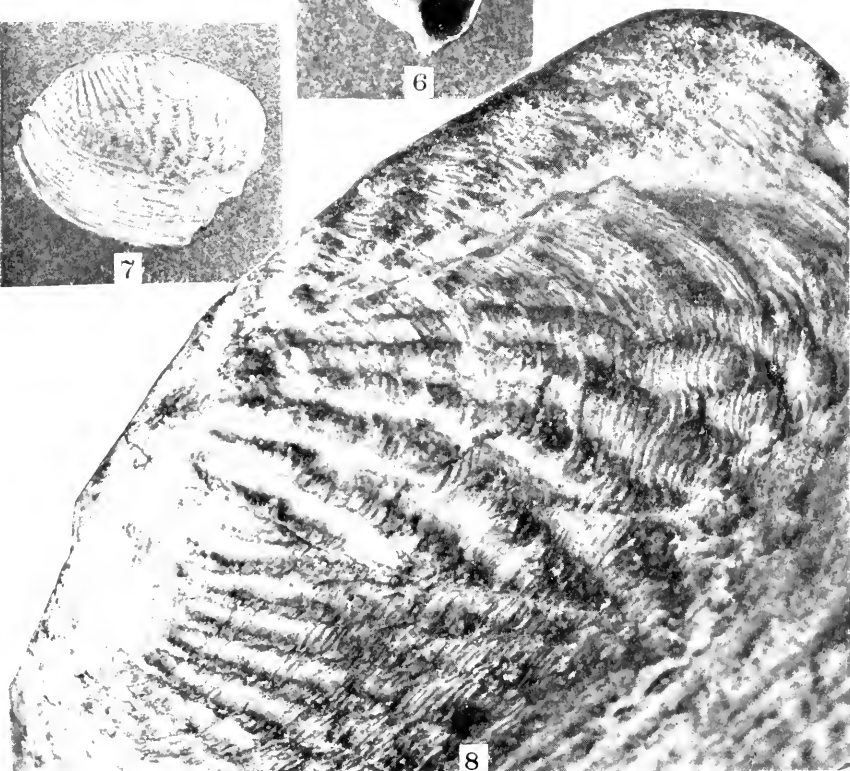
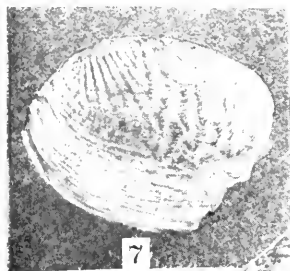
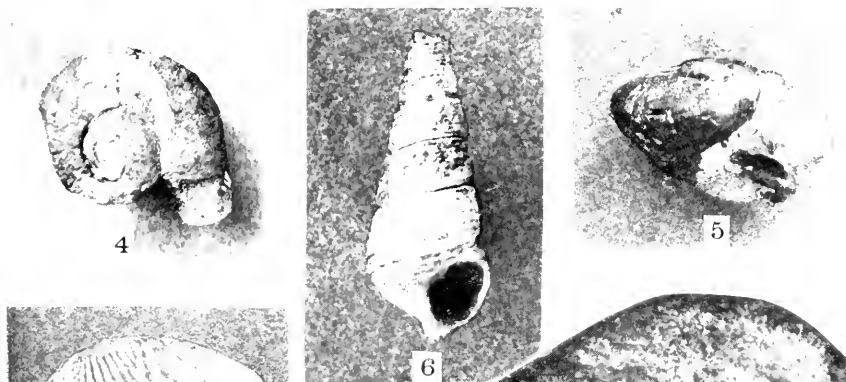
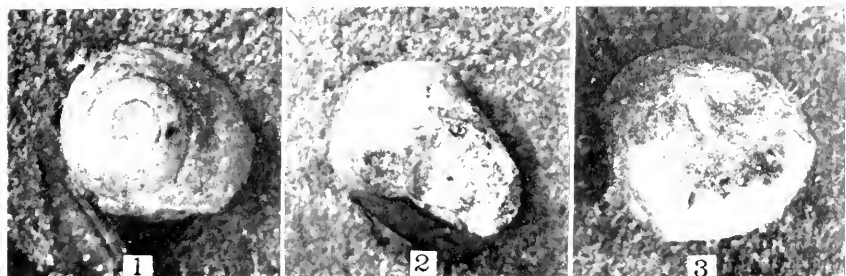
⁵ *Castalia pazi* Hidalgo, 1868. Journ. Conchyl., p. 353, pl. 13, fig. 6.

⁶ *Tetraplodon linki* Marshall, 1926. Proc. U. S. Nat. Mus., vol. 69, art. 12, p. 6, pl. 1, figs. 6, 7; pl. 3, fig. 2.

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FOSSIL MOLLUSKS FROM ECUADOR

- 1, 3, *Potamolithoides biblianus*, new species, type, $\times 5$; 4, 5, *Pomarea bibliana*, new species, type, natural size; 6, *Shppardiccha bibliana*, new species, type, $\times 2$; 7, *Ecuadoria bibliana*, new species, natural size; 8, *E. bibliana*, type, $\times 5$.

TWO NEW NEMATODES, AND NOTES ON NEW FINDINGS OF NEMATODES PARASITIC IN AMPHIBIA ¹

By A. C. WALTON

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Through the courtesy of Dr. M. C. Hall, chief of the zoological division of the United States Bureau of Animal Industry, a number of unnamed nematode parasites of amphibian hosts were recently sent to the writer for examination. Two apparently new species were found, and new host records for several other little-known species were obtained.

The genus *Pharyngodon* is represented up to this time by only one species that has been reported from an amphibian host: *P. batrachiensis* Walton, 1929, from a tadpole of *Rana pipiens*. Female worms taken from adult specimens of *Rana pipiens* and of *R. clamitans* afford the basis for establishing a second species from amphibian hosts.

PHARYNGODON ARMATUS, new species

FIGURE 1, a-c

Specific diagnosis.—*Pharyngodon*: Male, unknown. Female, short (3.5 mm long), of medium width (240 μ), and tapering abruptly at the posterior end to a naked spikelike tail. Anterior end shows distinct annulations, which become indistinct caudad; inconspicuous lateral flanges present. Mouth surrounded by three indistinct lips; no buccal cavity or vestibule present, but the pharynx seems to be protected by chitinous plates for a short distance back from the mouth. Excretory pore, like that of the other species from an amphibian host, is opposite, instead of caudad to, the esophageal bulb. Vulva just in front of midregion of body. Eggs a very slightly flattened ovoid with but one distinct terminal plug; segmented (4- or 8-celled) at time of oviposition.

This form resembles *P. batrachiensis*, but in view of the presence of the armored pharynx, the relatively different measurements of important structures, and the difference in the eggs, the variations seem to be of specific importance.

¹ Contribution No. 42 from the Biological Laboratories of Knox College.

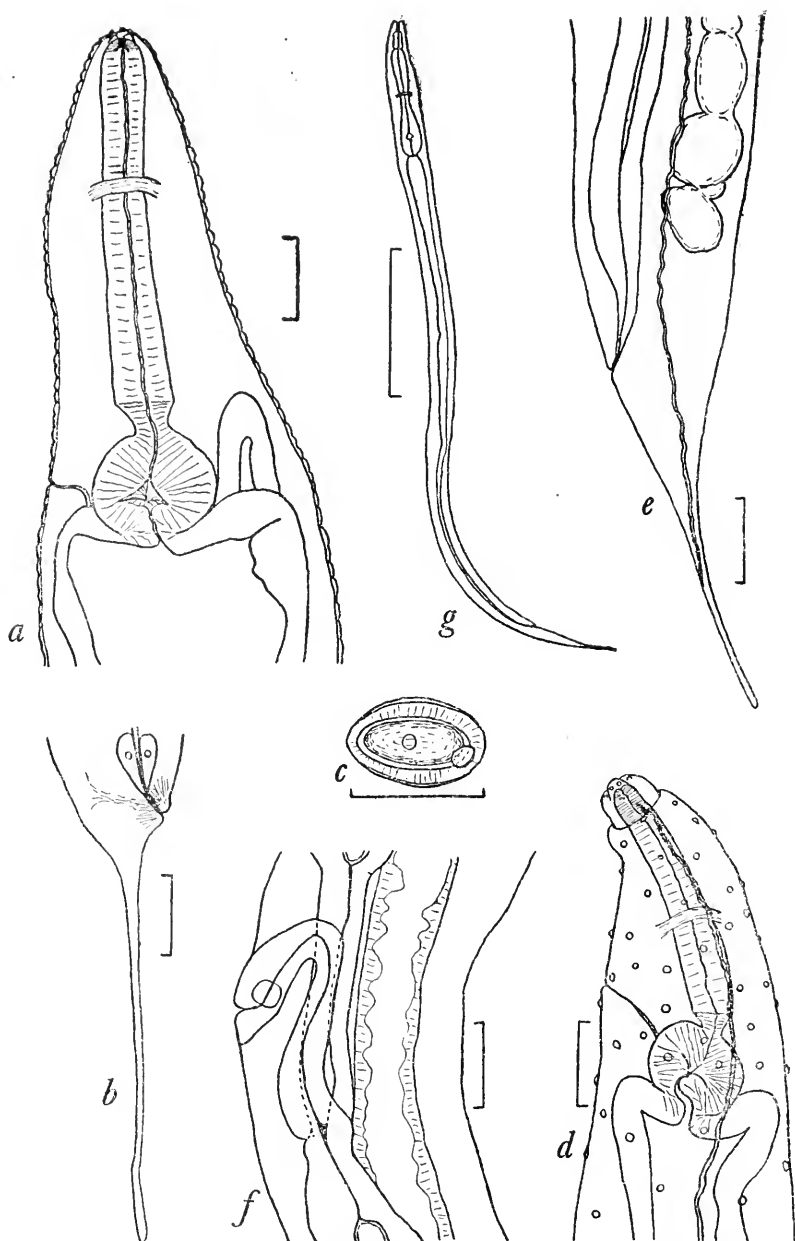


FIGURE 1.—*a*, *Pharyngodon armatus*, lateral view of anterior end of female; *b*, *P. armatus*, lateral view of posterior end of female; *c*, *P. armatus*, egg; *d*, *Orysomatium punctatum*, lateral view of anterior end of female; *e*, *O. punctatum*, lateral view of posterior end of female; *f*, *O. punctatum*, vulvar region; *g*, *O. punctatum*, intra-uterine larva. Scale for all figures equals 0.1 mm

The general measurements of the females of the two species are as follows:

Measurement	<i>P. armatus</i>	<i>P. batrachiensis</i>
Total average length.....	3.5 mm.....	4.2 mm.
Width at vulva.....	0.24 mm.....	0.36 mm.
Length of esophagus.....	0.28 mm.....	0.56 mm.
Esophageal bulb.....	0.15 by 0.15 mm.	0.125 by 0.15 mm.
Distance from nerve ring to lips.....	0.175 mm.....	0.165 mm.
Distance from excretory pore to lips.....	0.36 mm.....	0.61 mm.
Distance from vulva to lips.....	1.5 mm.....	1.8 mm.
Distance from anus to tip of spike.....	0.5 mm.....	0.9 mm.
Length of spike.....	0.5 mm.....	0.75 mm.
Eggs.....	60 μ by 100 μ (4 to 8 celled).	35 μ by 100 μ (1 celled).

The name *armatus* is given because of the armored condition of the anterior end of the esophagus.

Type specimens.—U.S.N.M. Helm. Coll. (Bureau of Animal Industry) No. 27061. From *Rana pipiens* and *R. clamitans*, intestine. Collected by Bruce Reynolds, August, 1927, at University, Va.

OXYSSOMATIUM PUNCTATUM, new species

FIGURE 1, *d-g*

Material collected from *Rana vittigera* (Los Baños, Philippine Islands) includes female specimens of a species of *Oxyssomatium*, which differs from the other previously described species from the same area in several important features.

Specific diagnosis.—*Oxyssomatium*: Lips distinct and each provided with two papillae. Head definitely separated by a constriction from the rest of the body, a characteristic not found in other species of this genus.

Male, unknown. *Female*, 3.6 mm long. Anterior end of worm characterized by the presence of small cuticular bosses, again a specific character for this species only. A very short pharynx precedes the short esophagus, which is followed by a distinct flasklike bulb opening into a greatly dilated intestine. Lateral alae extend from lip region to base of tail spike. Vulva in anterior half of body. Uteri opposed; ovaries amphidelphous. Eggs contained well-defined larvae, some of which are apparently hatched *in utero*.

The average measurements as compared with those of the females of the other species recently reported from Philippine amphibian hosts are as follows:

Measurement	<i>O. punctatum</i>	<i>O. ranæ</i>
Total average length.....	3.6 mm.....	3.8 mm.
Width at vulva.....	0.24 mm.....	0.23 mm.
Length of pharynx.....	0.045 mm.....	0.03 mm.
Length of esophagus.....	0.3 mm.....	0.265 mm.
Esophageal bulb.....	105 μ by 115 μ	65 μ by 85 μ .
Distance from nerve ring to lips.....	0.175 mm.....	0.15 mm.
Distance from excretory pore to lips.....	0.28 mm.....	0.28 mm.
Distance from vulva to lips.....	1.6 mm.....	1.8 mm.
Distance from anus to tip of tail.....	0.45 mm.....	0.23 mm.
Eggs.....	62 μ by 105 μ	56 μ by 76 μ .
Larvæ in utero.....	17 μ by 420 μ	Present.

The name *punctatum* is given because of the characteristic cuticular bosses of the anterior end of the worm.

Type specimens.—U.S.N.M. Helm. Coll. (Bureau of Animal Industry) No. 25874. From *Rana vittigera*, intestine. Collected by B. Schwartz, 1921–22, Los Baños, Philippine Islands.

RECORDS OF NEMATODES PARASITIC IN AMPHIBIA

The following list gives the already known species in the collection and indicates their host distribution, many of which are new records:

1. *Agamascaris odontocephala* Steiner, 1924. From *Rana catesbeiana*, Virginia, U.S.N.M. Helm. Coll. No. 1569; *Rana catesbeiana*, Washington, D. C., U.S.N.M. Helm. Coll. No. 7864; *Rana clamitans*, Washington, D. C., U.S.N.M. Helm. Coll. No. 2298; *Rana clamitans* and *R. sylvatica*, Baltimore, Md., U.S.N.M. Helm. Coll. No. 2864; "frogs," Washington, D. C., U.S.N.M. Helm. Coll. No. 2865. The other reported host is *Hyla cinerea*, United States.

2. *Zanclophorus cryptobranchi* Walton, 1930. From "*Cryptobranchus*," Philadelphia, Pa., U.S.N.M. Helm. Coll. No. 15700. The only known host is *Cryptobranchus alleganiensis*, United States.

3. *Aplectana americana* Walton, 1929. From *Scaphiopus couchii*, Texas, U.S.N.M. Helm. Coll. No. 27895. The other reported hosts are *Rana catesbeiana*, *R. palustris*, and *R. pipiens*, all from the United States.

4. *Oxysomatium ranæ* Walton, 1931. From "frogs," Los Baños, Philippine Islands. The only identified host is *Rana magna* (?), Luzon, Philippine Islands.

5. *Rhabdias ranæ* Walton, 1929. From "frogs," Washington, D. C., U.S.N.M. Helm. Coll. No. 26828. Other known hosts are *Acris gryllus*, *Rana halecina*, *R. palustris*, *R. pipiens*, and *R. sphenoccephala*, all from the United States.

Travassos (1930) argues that *Rhabdias ranae* Walton, 1929, is in reality *Rhabdias entomelas* (Leidy, 1851) Travassos, 1930. The original description by Leidy might refer to any species of the genus *Rhabdias*, and since there are several species reported from the United States it seems impossible to determine which one of these Leidy might have had at hand. It is evident that Leidy recognized that his form was not *Rhabdias bufonis*, but until better proof is offered, it can not be stated *a priori* that the first modern description of a species of *Rhabdias* other than *R. bufonis* from North American frogs must necessarily be a redescription of the *Ascaris entomelas* of Leidy, 1851.

6. *Oswaldocruzia leidyi* Travassos, 1917. From *Pseudacris feriarum*, Virginia, U.S.N.M. Helm. Coll. No. 19414. The other reported hosts are *Bufo americanus* and *Hyla cinerea*, both from the United States.

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A FOSSIL RHINOCEROS (*DICERATHERIUM ARMATUM* MARSH) FROM GALLATIN COUNTY, MONTANA

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The United States National Museum has in its collections a partial skull of a rhinoceros (No. 11682), consisting of the front with nasals and most of the upper cheek teeth. Associated are two skull fragments, one including the right glenoid region, the other the left glenoid region, the skull roof, and the basisphenoid. The material was collected by C. A. Kinsey, of Belgrade, Mont., about 2 miles south by west of the present town of Three Forks and 1½ or 2 miles west of the Madison River. The position (see 1928 U. S. Forest Service map of Gallatin National Forest) is in sec. 11, T. 1 N., R. 1 E., at the end of a point jutting out from the western side of the bench in the fork of the roads south from Three Forks. On the Three Forks sheet of the United States Geological Survey topographic map, edition of 1895, reprinted in 1920, Three Forks occupies its former position. The locality, on this map, is situated near the northern end of the intermittent stream that drains toward the Jefferson River, between the Madison River and Willow Creek. The nearest outcrops of the Madison Valley formation on the east bank of the Madison River are 2½ to 3 miles to the east.

With exemplary public spirit, Mr. Kinsey presented this material to the United States National Museum. He furnished the data regarding the locality and sent me, for study, the other rhinoceros material from this region, referred to in this paper. C. W. Gilmore kindly submitted the specimen to me for description. I am indebted to Prof. C. C. Mook, who checked my interpretation of the stratigraphy of this occurrence on the basis of his personal acquaintance with the region.

The skull in question (see pls. 1-3) is that of one of the larger American pair-horned rhinoceroses, and is clearly referable to the genus *Diceratherium* in the restricted sense. It is equally clear that it is close to the type species, *D. armatum* Marsh. (For figures of the type of *D. armatum*, see Peterson, 1920, fig. 10 and pl. 57; also Troxell, 1921, fig. 5.) The tooth pattern is rather simple. All four premolars have their cross-lophs complete and parallel. Except for the mures,

which dam the median valleys of P^{2-4} , no accessory folds occur on the cheek teeth. Although the teeth are worn, there can be no doubt of the presence of mures on P^{2-4} as in *D. armatum* (Yale Peabody Museum No. 10235) from the Upper Oligocene of the north fork of White River (presumably in South Dakota rather than Nebraska). The type (Y. P. M. No. 10003), from the John Day of Oregon, likewise has mures on P^{2-3} , but differs in their absence on the fourth premolars. The internal cingula are interrupted by both protocone and hypocone in P^1 and M^1 , and are complete in P^{2-4} and M^3 . The protocone of M^2 is moderately demarked from the protoconule by grooves, both anteriorly and posteriorly; that of M^3 is barely demarked from the protoconule anteriorly and is set off by a moderate constriction to the rear. This is the typical condition in members of the *Subhyracodon-Diceratherium* line. The nasal horn cores are somewhat less elongated and rather more prominent and everted than in either of the other two skulls of *D. armatum*. The infraorbital canal opens above the anterior portion of P^3 .

The greatest apparent difference from the type specimen is that in the Montana individual the nasals extend almost twice as far in front of the horn cores. However, as indicated by Peterson (1920, fig. 10, p. 415, and pl. 57), the anterior ends of the nasals are broken off in the type so that this difference has no real significance. The Montana specimen is almost exactly the same size as the type of *D. armatum*, as shown by the measurements in Table 1; in fact, my measurements of the Montana skull are as close to either Troxell's or Peterson's measurements of the type skull as their measurements of that skull are to each other. Inspection of these figures indicates that such discrepancies as occur are due to choice of different loci for taking measurements. The chief discrepancy is in the antero-posterior dimension of the individual teeth. If the greatest measurement along the ectoloph is taken, instead of the length along the midline of the tooth, the agreement is considerably closer. There is, then, every reason for referring the Montana skull to *Diceratherium armatum* Marsh, as even the individual differences are of rather a minor character.

From the viewpoint of paleogeographic distribution, this specimen of *D. armatum* partially connects the two previously widely separated occurrences of this species in Oregon and the Great Plains.

This specimen's chief importance, however, is that it dates, in part at least, the beds on the west side of the lower Madison River, which are apparently unconformable below the late Miocene or early Pliocene Madison Valley formation. Douglass, in 1903 (p. 149), perhaps referred to these beds, saying: "In the lower Madison Valley, where the upper [White River] beds are so well exposed, the material is mostly fine. The exact horizon of these upper beds is uncertain, as no good mammals have been found, but they lie unconformably under the

Loup Fork. I have always considered them as White River." The discovery of this skull is an approximate confirmation of Douglass's opinion.

That the beds on the west side of the Madison River, south of Three Forks, may not be of John Day age, throughout, is suggested by a right M^3 referable to (?) *Aphelops ceratorhinus* Douglass in Mr. Kinsey's collection. (Douglass collected the type specimen in the lower Madison Valley, about 5 miles south of Logan.) Mr. Kinsey found this tooth, in loose dirt, on the opposite (southern) side of the westwardly jutting point on which he found the *Diceratherium* skull.

TABLE I.—Measurements of two specimens of *Diceratherium armatum* Marsh

MEASUREMENT	U.S.N.M. No. 11682		Y.P.M. No. 10093 (HOLOTYPE)	
	Right	Left	After Troxell, 1921	After Peterson, 1920
	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>
P1-M ³	250.0	-----	254	248
P2-M ³	225.0	-----	-----	-----
P1-t.....	128.0	128.7	129	-----
P2-t.....	102.0	104.6	-----	-----
M1-t.....	126.1	-----	144	-----
P1, A-P.....	26.5	26.5	29	29
P1, Tr.....	° 22.4	° 23.1	27	24
P2, A-P.....	31.1	31.5	33	31
P2, Tr.....	° 41.0	° 42.7	39	40
P3, A-P.....	35.5	36.1	39	35
P3, Tr.....	51.0	50.5	47	45
P4, A-P.....	35.3	36.5	40	38
P4, Tr.....	54.3	53.5	51	49
M1, A-P.....	40.0	-----	52	44
M1, Tr.....	54.3	-----	53	53
M2, A-P.....	43.4	-----	55	53
M2, Tr.....	57.6	-----	57	53
M3, A-P.....	44.6	-----	47	45
M3, Tr.....	52.8	-----	50	50
A-P, rear of nasal rugosity to anterior tip of nasal.....	124.5	116.0	-----	-----

° Measured across metaloph.

About 5 years ago, a rhinoceros lower jaw with left P_3 - M_3 , which also is probably referable to (?) *Aphelops ceratorhinus*, was collected about a mile south of this locality, the exact location and condition of occurrence being unknown. It was this discovery that led to Mr. Kinsey's collecting in this region. If the two specimens were in place they indicate the presence of otherwise unrecognized Madison Valley beds on the west side of the Madison River. The matrix adhering to the outside of this skull is a coarse sandstone, indicating deposition in a stream channel; some of the matrix inside the fragment of the brain case is much finer. This bed, then, is uppermost Oligocene, or,

according to some, lowermost Miocene. It is entirely distinct from the earlier Oligocene Thompson Creek Beds, northwest of Three Forks, and from the late Miocene or early Pliocene Madison Valley Beds, on the east side of the river. When more is known about this bed, it may deserve a special geographic name, but for the present it will probably be sufficient to call it the John Day equivalent in the lower Madison Valley. It may possibly prove to be synchronous with some one of the scattered Oligocene patches of western Montana, named by Douglass.

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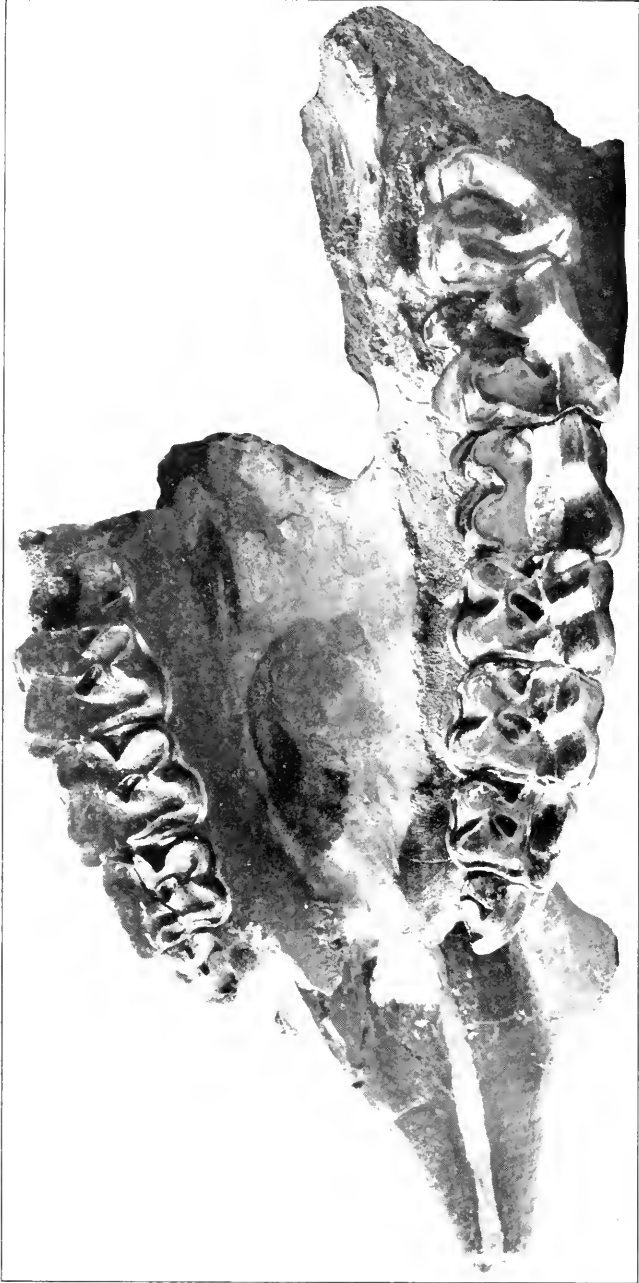
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SKULL ROOF OF DICERATHERIUM ARMATUM MARSHI
U. S. N. M. No. 1182. Two-fifths natural size.



RIGHT SIDE OF SKULL OF DICERATHERIUM ARMATUM MARSH
U.S.N.M. No. 11682. Two-fifths natural size.



PALATE OF DICERATHERIUM ARMATUM MARSH
U.S.N.M. No. 1682. Two-fifths natural size.

NEW FRESH-WATER GASTROPOD MOLLUSKS OF THE GENUS CHILINA OF SOUTH AMERICA

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The five new species herein described have recently been added to the collection of the United States National Museum, or have been in the collection unnamed or wrongly identified.

Genus CHILINA Gray

CHILINA BULLOCKI, new species

PLATE 1, FIGURES 4, 6

Shell rather thin, ovate. Whorls moderately rounded, but much longer than wide. Axial sculpture of very obscure incremental striae, slightly crenulating the suture. Spiral sculpture of faint indications of revolving striae. Color of type dark olive-green with a band of interrupted reddish spots a short distance below the suture and three nearly continuous bands of the same color lower down on the whorl. Externally these bands are faint, but in the aperture they show plainly although thinly coated with the white and pinkish of the interior. Aperture about two-thirds the length of the shell, outer lip simple, columellar lip white, its lower part nearly straight, broad, reflected over a false umbilicus on the left margin, and with an oblique strong, entering fold at its upper end. Parietal wall with a thin white callus and a revolving plait on its lower portion. Interior whitish, flushed with pink, the reddish bands of the exterior showing plainly.

Type.—The type (U.S.N.M. No. 414163) measures: Length, 27 mm; diameter, 15 mm; length of aperture, 19 mm; axial length of body whorl, 23 mm. It and 24 paratypes (U.S.N.M. Nos. 414164, 414165) were collected and presented by D. S. Bullock, of the Escuela Agricola de "El Vergel," at Angol, Chile, and came from the "mill canal that comes from Rio Malleco, El Vergel, Angol, Chile, November, 1928." Four other paratypes were returned to Mr. Bullock.

Remarks.—As shown by the figures, this species is related to *C. iheringi* Marshall, but is much smaller, and more ovate. Like others from this general region, this species shows a tendency to have the whorls shouldered, the body whorl inflated, and the length of the shell in proportion to diameter to become less. It is related also to *C. bulloides* Orbigny.

Plate 1, Figure 6, shows the color marking revealed by removal of the periostracum of a paratype (U.S.N.M. No. 414164).

CHILINA IHERINGI, new species

PLATE 1, FIGURE 8

Shell large, inflated, ovoid. Spire short, apex lost. Body whorl very large, about seven-tenths of the length of the shell, subcylindrical, its outer wall nearly vertical, slightly shouldered. Axial sculpture consisting of fine incremental threads, the longer rest periods emphasized by greater strength and deeper color. Spiral sculpture of irregularly spaced impressed lines and crude riblets, which become more prominent on the basal area. Surface slightly malleated. Suture crenulated. Color light olive-yellowish with four revolving bands of reddish, the upper one well marked, the others hardly visible except when viewed through the shell by transmitted light. Aperture very long, its outer wall slightly compressed, outer lip thin. Interior whitish, the external bands showing through, especially if held up to the light. Columella straight, stout, broad, white, with a strong entering fold at its upper part. A false umbilicus formed by the reflecting of the left margin of the columella. Parietal wall with a thin callus.

Type.—The type (U.S.N.M. No. 414166) measures: Length, 45 mm; diameter, 27 mm; length of aperture, 30 mm. It and two paratypes (U.S.N.M. No. 363765) come from Lake Todas Santos, Province of Llanquihue, Chile, received from Dr. H. von Ihering. This lake is on the Pacific side of the Andes and drains into the Gulf of Corcovado. A fourth specimen (U.S.N.M. No. 362988) was received from Dr. F. Felippone, with the general locality, Chile. It is almost an exact counterpart of one of the paratypes and probably came from the same locality.

Remarks.—Until lately the author regarded this as an optimum condition of the inflated form of *C. oldroydae* Marshall. The great size of *C. iheringi* and the different locality indicate that they belong to two species or to two subspecies of the same original stock.

CHILINA LLANQUIHUENSIS, new species

PLATE 1, FIGURE 1

Shell globose-ovoid, polished. Whorls well rounded; sutures not deep, but margined by a stout revolving thread. Axial sculpture weak, consisting of faint threads of growth, the rest periods more marked in strength and darker color. Spiral sculpture lacking. Color dark olive-green marked with five bands of spots of chestnut, scarcely visible outside, but very prominent within. Body whorl slightly inflated, outer lip thin. Columella slightly broadened, erect, its upper extremity with a sharp oblique entering fold. Parietal wall rather thickly coated with callus and bearing a small spiral fold at its middle portion, its upper portion stained with bright chestnut. Interior white, the color bands very prominent.

Type.—The type (U.S.N.M. No. 414167) measures: Length, 16 mm; diameter, 13 mm. It and a paratype (U.S.N.M. No. 363766) were presented by Dr. H. von Ihering and came from Lake Llanquihue, Chile. This lake drains directly into the Pacific Ocean, and has also a connection by canal with the Gulf of Chaco, the northern end of the Gulf of Corcovado.

Remarks.—This species shows no very close relationship to any other. It may be distantly related to its geographically nearest neighbor, *C. bulloides* Orbigny, of the island of Chiloe, Chile. A highly polished periostracum such as possessed by this species, while not unknown in other species, is of rare occurrence.

CHILINA SIMPLEX, new species

PLATE 1, FIGURES 2, 9

Shell rather thin, slender, elongate-ovoid. Spire very short, about 1 mm in length; the body whorl very long, about 13 mm; suture well marked, but not shouldered. Axial sculpture consisting of many fine threadlike striae, invisible to the unaided eye but revealed by a lens. Rest periods easily seen, partly because stouter than the growth striae, but more because they are emphasized by darker color. No indication of spiral striae. Color almost uniform light olive-green, with two scarcely visible bands of pale reddish arrowhead spots, which are more easily seen within the aperture or by transmitted light. One of these bands is a short distance below the suture, the other two-thirds down the whorl. There are also a few faint spots of the same color, indicating the possibility of more bands possible to the species. Aperture long, rather narrow. Outer lip simple, columellar lip white, rather broad and

nearly flat and reflected to form a slight appearance of an umbilicus. The fold on the columella, characteristic of the genus, is very small, situated rather high up and within, so that it does not show in a front view. Parietal wall with a thin, transparent callus.

Type.—The type (U.S.N.M. No. 414169) measures: Length, 14.5 mm; diameter, 7.5 mm; length of aperture, 10 mm. It and a younger specimen (U.S.N.M. No. 363022) were presented by Mrs. T. S. Oldroyd and were collected by J. W. Pemberton, December 26, 1914, in the Santa Cruz River at the outlet of Lake Argentino, Province of Santa Cruz, Argentina. The latitude and longitude quoted on the label are 50° 15' S. and 71° 48' W., respectively.

Remarks.—This interesting species makes a near approach to being unicolored and upon cursory examination it would be said to be uniform light olive-green, but closer scrutiny shows it to possess the reddish spots and tinges characteristic of the genus. What spots show are arranged in bands and have a marked tendency to assume an arrowhead pattern. The sculpture, though nearly microscopic, is essentially the same as that of *C. limnaeiformis* Dall, type of Dall's subgenus *Pseudochilina* (U.S.N.M. No. 56423), and were that subgenus valid the species might be placed with it. In the weak, nearly lacking columellar fold it would fall into the subgenus *Acyrogonia* Mabile, in which the columellar plait is said to be lacking, but that subgenus is founded upon a character which shows every degree of variation in strength as we turn from species to species. I have never seen a specimen of *Chilina* in which the columellar fold was entirely lacking. It may be very weak and nearly hidden by being set high up on the columella and nearly on its inner edge, but careful examination always has shown that it is present and fulfills in all particulars the definition of typical *Chilina*. The new species here described is a case exactly to the point. *C. simplex* is related to a number of other species, perhaps the nearest being *C. fulgurata oligoptyx* Pilsbry. Both are probably descended from the same or nearly related ancestors. It is related also to *C. parchappi minor* Marshall of Mar del Plata, Argentina. So far as known to the author, all the species of *Chilina* which have a very weak fold belong in the Atlantic drainage. The one described by Mabile (*C. fusca*) and the one by Mabile and Rochebrune (*C. nervosa*) came from Punta Arenas, Argentina, which is near the half-way point of Magellan Strait and hence can be said to be in neither the Atlantic nor the Pacific drainage, but in both.

CHILINA NEUQUENENSIS, new species

PLATE 1, FIGURE 5

Shell rather thin, slender, very elongate, turreted. Spire one-half the length of the whole shell, sharply acuminate. Whorls about 6.5 (nuclear whorl lost). Early portion of shell normal but a marked ridge begins to develop upon the upper portion of the whorl, which on the later whorls becomes almost a carina, forming a sloping shoulder. Suture well marked, slightly crenulate. Axial sculpture consisting of numerous, irregular growth riblets, with longer rest periods more strongly marked. Spiral sculpture of two impressed lines near the suture, several revolving riblets on the lower part and faint indications of spiral striae. The crossings of the spiral riblets by the axial sculpture give a malleated appearance to the lower portion of the body whorl. Ground color olive-yellowish with zigzag flashings of reddish on the upper whorls, two bands of arrow-head markings of the same color, and three like-colored plain bands on the body whorl. Aperture very long and narrow, its outer wall perpendicular, outer lip broken off but evidently simple. Columella arcuate, rather broad, white, with a prominent entering oblique fold near its middle portion. Parietal wall with a thin, white callus. Color of interior pinkish overlaid with a thin deposit of white, the exterior banding and arrow markings showing through.

Type.—The type (U.S.N.M. No. 414168) measures: Length, 37 mm; diameter, 18 mm; length of aperture, about 18 mm. It was collected in December, 1926, in "Las Lagunas," Province of Neuquen, Argentina, by Senor Mendez, of Santiago, Chile, and was presented by D. S. Bullock, of Angol, Chile. As the Province of Neuquen is on the east side of the Andes, this would be in the Atlantic drainage.

When received, the specimen was completely encrusted, except the aperture, with a thick deposit of iron, through which no hint of the colors could be seen and which to a large degree concealed the form of the shell. Oxalic acid quickly removed the iron, revealing a good specimen except for the lost nucleus and broken outer lip.

Remarks.—The nearest relative is *Chilina oldroydae* Marshall, which occurs in Lake Fetalafquen, Province of Chubut, not very far south of Neuquen. *C. oldroydae* is a much larger, more inflated shell than *C. neuquenensis*. The former, as shown in figures with the original description, varies from bulimoid form to a turreted form on one side and to a nearly globose form on the other side. The two species may have had a common ancestry, or *C. neuquenensis* may be a subspecies of *C. oldroydae* or an extreme development of the turreted form of the latter. In slenderness, *C. neuquenensis* vies with *C. fuegiensis* E. A. Smith for first place, but in other respects the two species are not closely related.

CHILINA LIMNAEFORMIS Dall

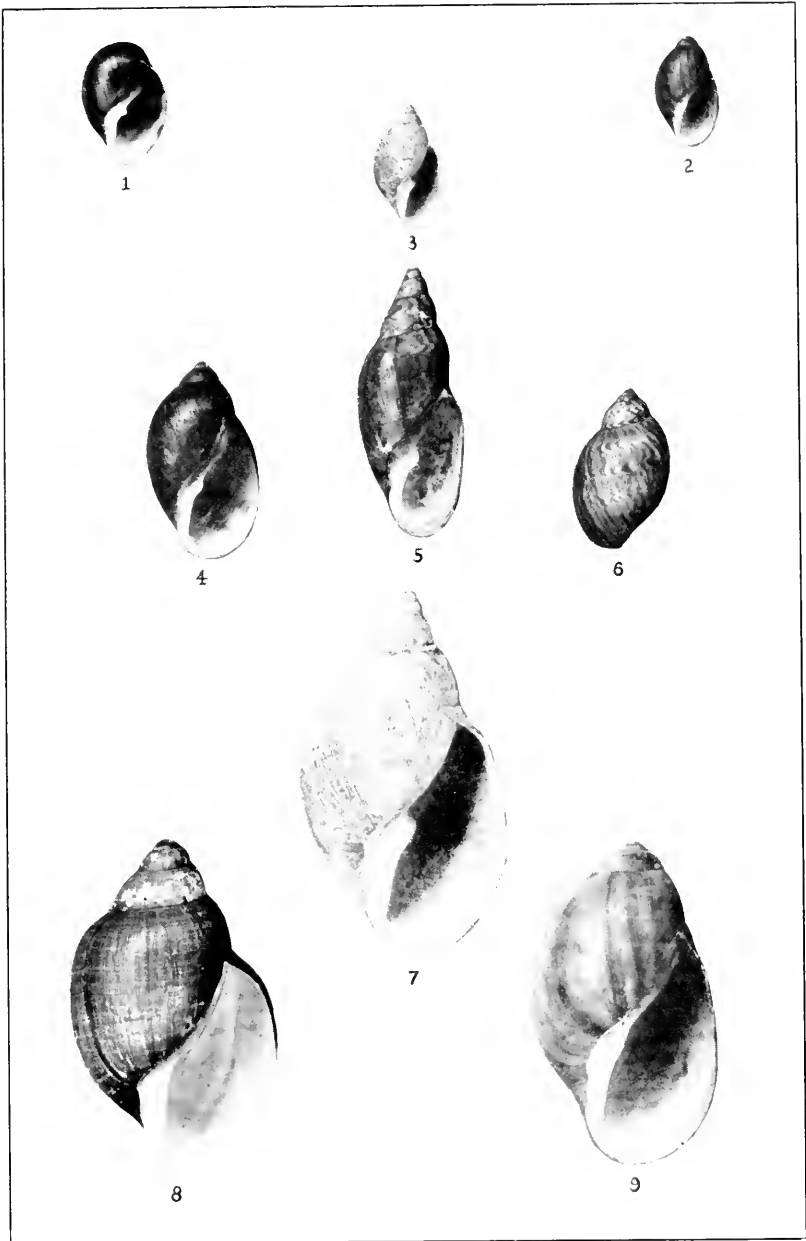
PLATE 1, FIGURES 3, 7

1870. *Chilina (Pseudochilina) limnaeformis* DALL, Ann. Lyc. Nat. Hist. (New York), vol. 9, p. 357.
1881. *Chilina (Pseudochilina) limnaeformis* E. A. SMITH, Proc. Zool. Soc. London, p. 846.
1911. *Chilina limnaeformis* DALL, in Pilsbry, Non-marine Mollusca of Patagonia, Reports of Princeton University Expedition to Patagonia, 1896-1899, vol. 3, p. 531.

This species is the type of the subgenus *Pseudochilina* Dall, described at the same time. The subgenus was defined thus: "shell thin, covered with a rough fibrous epidermis; spire elevated, acute." Under the description of the species, he says: "The curious epidermis and broad plicate columella alone distinguished this singular shell from a *Limnaea*." As this type (U.S.N.M. No. 56423) has never been figured, a view of it is given in this paper.

By "fibrous epidermis" Dall probably meant that the axial sculpture consists of numerous threadlike incremental lines. In discussing this type specimen Pilsbry said: "The irregular or fibrous surface which served to characterize the subgenus, seems to me to be wholly due to erosion, the cuticle or periostracum being lost from the unique type in the National Museum. In other characters the shell is a typical *Chilina*."

The shell was more or less covered with a deposit of lime and dirt as often occurs with shells, especially those from lacustrine habitats. When this deposit is removed, the periostracum is revealed as present on all but a portion of the front aspect and is normal. The "fibrous" appearance is due to the axial incremental threads underlying the periostracum. Pilsbry is right in thinking the species is not subgenerically different from the genus. The locality quoted, Chile, is indefinite. The shell probably classifies with others having a rather thin shell, and a broad columella with a prominent, nearly horizontal, fold such as *C. oldroydae* Marshall, and *C. iheringi* Marshall of the present paper. It may eventually prove to be a young specimen of some already described species.



GASTROPODS OF THE GENUS CHILINA

1. *Chilina llanquihuensis*, new species; 2. *C. simplex*, new species (natural size); 3. *C. (Pseudochilina) lymnaeiformis* Dall (type, natural size); 4. *C. bullocki*, new species; 5. *C. neuquenensis*, new species; 6. *C. bullocki*, paratype showing coloring revealed by removal of the periostracum; 7. *C. (P.) lymnaeiformis* Dall (type, $\times 3$); 8. *C. itheringi*, new species; 9. *C. simplex*, new species ($\times 3$).

A NEW SPECIES OF EXTINCT TURTLE FROM THE UPPER PLIOCENE OF IDAHO

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Among the fossils obtained by the Smithsonian expedition of 1930 under the direction of the late Dr. J. W. Gidley, exploring in the vicinity of Hagerman, Twin Falls County, Idaho, were two unusually well-preserved emydid turtles. One of these is of more than common interest in having the complete skull, lower jaws, hyoid arch, and much of the appendicular skeleton present. So complete a specimen is a rare occurrence among the extinct *Chelonia*, and an opportunity is presented for comparison with living forms that is seldom offered by fossil remains of these animals.

Except for a slight difference in size the two specimens are structurally in close accord, both pertaining to a new species for which the name *idahoensis* is proposed. They are provisionally referred to the genus *Pseudemys*.

PSEUDEMYS IDAHOENSIS, new species

Type.—U.S.N.M. No. 12059 consists of the nearly complete carapace and plastron; skull, lower jaws, hyoid arch, pectoral and pelvic girdles, 11 caudal vertebrae, incomplete humerus, femora and tibia, and much of an articulated hind foot. Collected by S. R. Wells, 1930.

Paratype.—U.S.N.M. No. 12060 consists of a nearly complete carapace and plastron. Collected by S. R. Wells, May 28, 1930.

Locality.—*Plesippus* Quarry, NW. $\frac{1}{4}$ sec. 16, T. 75, R. 13 E., near Hagerman, Idaho.

Horizon.—Hagerman lake beds, Upper Pliocene.

Description.—Both the type and paratype have suffered somewhat from post-mortem crushing, but otherwise they are in a nearly perfect state of preservation. There is a slight difference in size, and the carapace of the paratype is more distinctly sculptured than that of the type; otherwise the two are in perfect accord.

In outline the carapace (fig. 1) is elongate, broadly truncate in front, with a pointed posterior extremity. As a whole the shell appears to have been moderately elevated.¹

¹ In the descriptive matter to follow, two measurements are given, the first in each instance being of the type, the second, in parentheses, of the paratype.

The greatest length of the carapace is 318 mm (284 mm); the greatest width 220 mm (207 mm). The anterior margin is shallowly excavated at the center, the posterior margin strongly scalloped. The pygal region presents an exaggerated peculiarity of structure where it forms an inverted U-shaped notch covering the tail. This peculiarity causes a prominent posterior projection in the pygal region that is clearly discernible in the illustrations. (Pls. 1, 2.) Certain species of the extant *Graptemys* show a somewhat similar elevation of the pygal, but in none of the available specimens does it reach the extreme development of the fossil.

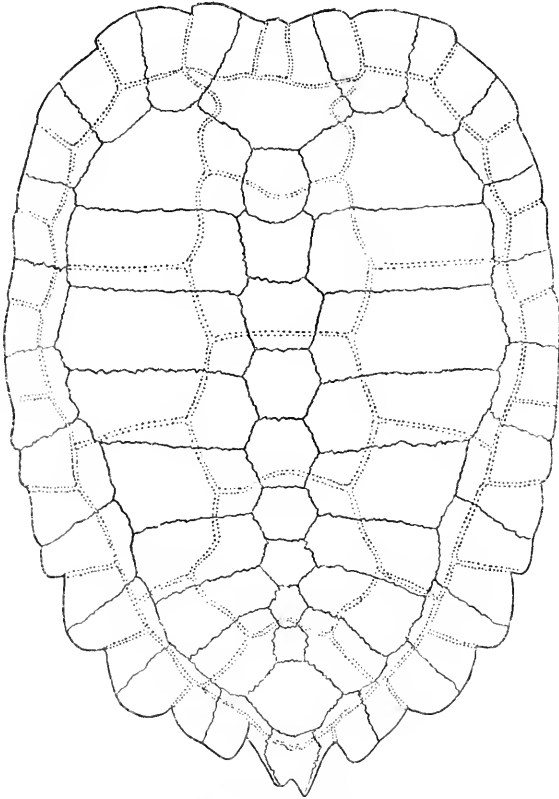


FIGURE 1.—Carapace of *Pseudemys idahoensis*, U.S.N.M. No. 12059
Type. One-third natural size.

The surface of the type carapace is undulating but without sculpture, except for faint growth ridgings across the outer ends of the costals. The paratype, however, shows additional sculpturing in the form of faint parallel grooves and ridges that cross the posterior half of the costals at right angles to their sutural borders. Likewise the peripheral surfaces are faintly sculptured. The plastral surfaces are devoid of ornamentation.

The nuchal bone has a length of 56 mm (52 mm), a width of 28 mm (33 mm) in front, and an extreme width of 62.5 mm (52 mm). The free border is acutely edged. The neurals are broad, hexagonal, with the widest end forward. Their dimensions are given in Table 1. The form of both the neurals and vertebrales is clearly shown in the figures.

The total length of the plastron (fig. 2) is 296 mm (274 mm), but on the midline from the front to the apex of the posterior notch it is 279 mm (255 mm). The plastron is shallowly concave in front and deeply notched behind. In proportions and general contour it has

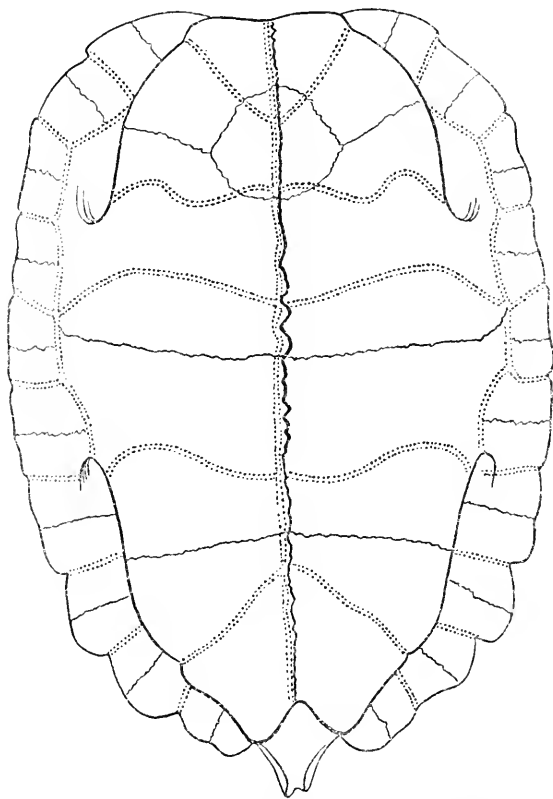


FIGURE 2.—Plastron of *Pseudemys idahoensis*, U.S.N.M. No. 12059
Type. One-third natural size.

a striking resemblance to the plastron of *Graptemys inornata* Loomis.² The anterior lobe has a total length of 86 mm (77 mm) and a width of 130 mm (122 mm). The anterior lip projects slightly beyond the general contour of the lobe and has a width of 65 mm (62 mm). Above it is shallowly spout-shaped.

² Loomis, F. B., Amer. Journ. Sci., ser. 4, vol. 18, p. 429, figs. 10, 11, 1904.

The entoplastron is 46 mm (37 mm) long and 53 mm (45 mm) wide. It is crossed posteriorly by the humero-pectoral sulcus.

The posterior lobe has a greatest width of 134 mm (129 mm) and a length of 100 mm (100 mm). Toward the posterior extremity the lobe narrows rapidly, terminating in a deeply notched end. The edges of the posterior lobe are everywhere sharply edged.

TABLE 1.—*Dimensions of neurals of Pseudemys idahoensis*

No.	Length		Width	
	Type	Paratype	Type	Paratype
	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>
1	31.5	28	26.5	23
2	28	23.5	30	23
3	30	-----	34.5	28.5
4	25	24	31	25
5	26	24	30	24
6	21.5	19	28	23
7	18	18	21	22
8	17	14	14	13

The bridge is 115 mm (95 mm) wide. The gulars extend along the midline for 43 mm (40 mm) and strongly overlap the entoplastron. The humerals meet on the midline for 27 mm (23 mm), the pectorals 46 mm (39 mm), the abdominals 66 mm (66 mm), the femorals 40 mm (34 mm), and the anals 56 mm (50 mm).

A third specimen, U.S.N.M. No. 12232, consisting of the posterior lobe of the plastron, was collected from this same fossil deposit by N. H. Boss in 1931. Except for its smaller size it is in perfect accord with the type specimens.

TABLE 2.—*Dimensions of vertebral scutes of Pseudemys idahoensis*

No.	Length		Width in front		Greatest width	
	Type	Paratype	Type	Paratype	Type	Paratype
	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>	<i>Mm</i>
1	50	47	67	58.5	67	58.5
2	58	56	53	-----	73.5	-----
3	60	50	58	-----	73	-----
4	58	56	48	-----	71.5	-----
5	50	47.5	33.5	-----	69	-----

The sulci outlining the scutes of the carapace are shallow but plainly impressed. Those between the marginal and costal scutes run along on the peripheral bones a short distance below the costo-peripheral sutures except in front and back, where they deviate outward farther away from the sutures. Posteriorly the sulcus crosses the midline on the anterior end of the pygal, as in *Trachemys hilli*. The form of the scutes is plainly indicated in Figure 1.

Skull.—The skull and articulated lower jaws were found in the matrix within the carapace. (Figs. 3, 4.) They are uncrushed and in beautiful preservation. Seen from above, the outline of the skull expands from the squamosal processes forward to the front of the quadrates. From the posterior ends of the maxillae it converges to the snout, which is squarely truncate. The

interorbital space is moderately wide and flat; posteriorly the upper surface is dished. The length of the skull from the snout to the occipital condyle is 57 mm, to the tip of the crest 70 mm, the width over the auditory chambers 50 mm. The interorbital space is 14 mm wide, the zygomatic arch 11 mm. The orbits are subcircular in outline and look forward and

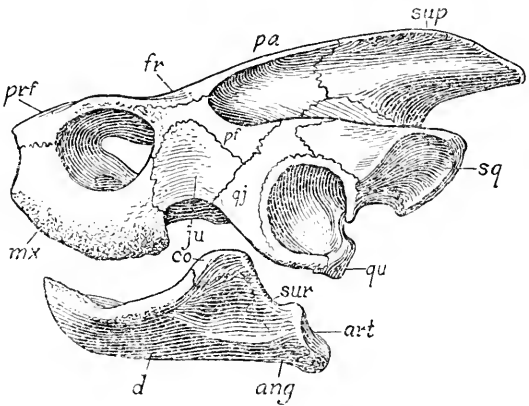


FIGURE 3.—Skull of *Pseudemys idahoensis*, U.S.N.M. No. 12059. Viewed from the left side. Type. *ang*, Angular; *art*, articular; *co*, coranoid process; *d*, dentary; *fr*, frontal; *ju*, jugal; *mx*, maxillary; *pa*, parietal; *pr*, postfrontal; *prf*, prefrontal; *qj*, quadratojugal; *qu*, quadrate; *sq*, squamosal; *sup*, supraoccipital; *sur*, surangular. Natural size

outward; the antero-posterior diameter is 14 mm, the vertical diameter 12 mm. The nasal opening is 9 mm wide, suboval in outline with the greatest diameter transverse. Choana between the eyes. Alveolar surfaces broad. Width of jaw at symphysis slightly less than horizontal diameter of the orbit.

Little is known of the skull in the extinct Emydidae. In a study of all North American materials of this family, Hay³ found only a single emydid skull, which he provisionally referred to *Echmatemys* sp. The present specimen therefore can not be contrasted with extinct members of this family.

In comparing the skull under consideration with available skulls of recent turtles in the National Museum collection, I find the closest

³ Hay, O. P., The fossil turtles of North America. Carnegie Inst. Washington Publ. 75, p. 297, pl. 45, figs. 11-13, 1905.

resemblances to be with the southern *Pseudemys rubriventris*. From this species, however, the fossil is at once distinguished by its larger size, broader pterygoids, less pronounced median alveolar ridge with finer denticulations, wider interorbital space, and squarely truncate nose. The lower jaws are similar in having the lower surface flattened and alveolar surfaces broad all around. The fossil mandible differs in the absence of a median longitudinal ridge and also in having the edge of the mandible nonserrated. Although in U.S.N.M. No. 12059 the beak is notched medially, there is no evidence of cusps on either side, as in *P. rubriventris* or *P. mobiliensis*.

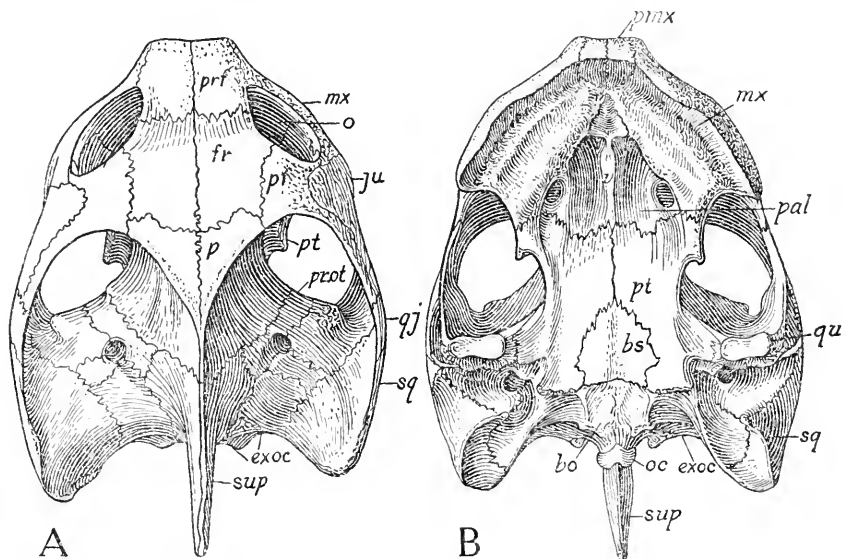


FIGURE 4.—Skull of *Pseudemys idahoensis*, U.S.N.M. No. 12059. Type. A, Superior view; B, inferior view. *bo*, Basioccipital; *bs*, basisphenoid; *exoc*, exoccipital; *fr*, frontal; *ju*, jugal; *mx*, maxillary; *o*, orbit; *oc*, occipital condyle; *p*, parietal; *pal*, palatine; *pf*, postfrontal; *pmx*, premaxillary; *prf*, prefrontal; *pr. ot.*, pro-otic; *pt*, pterygoid; *qj*, quadratojugal; *qu*, quadrate; *sq*, squamosal; *sup*, supraoccipital; *r*, vomer. Natural size

The hyoid apparatus is well developed. It consists of a more or less oblong flattened basilingual plate, which probably represents the fused ventral ends of the hyoid and branchial arches. Anteriorly it is drawn out to a point behind which there is an ovate opening through the bone on the median line. The second branchial arch is much the larger of the two structures. (See fig. 5.) The posterior or second branchial arch consists of two shortened bars that articulate with the bilobed end of the basilingual plate. So far as I have been able to ascertain this is the first extinct turtle to have the complete hyoid apparatus preserved.

The pectoral and pelvic girdles remain articulated within the carapace, and for that reason they are not available for critical com-

parison. The limb and foot bones do not display any distinguishing characteristics except that they are more robust in their proportions than in extant species of *Pseudemys* of corresponding size. The unguals of the articulated hind foot are elongate, with sharp tips, indicating that the type specimen may be a male.

Remarks.—Although in skull structure the type has its closest resemblances with *P. rubriventris*, the palatal surfaces of the jaws are so unlike that when considered in conjunction with differences found in the shells the question of their generic identity is raised. The alveolar surface of the mandible is much more like that of *Graptemys pulchra*, but the pointed skull and lack of palatal ridges at once distinguish this form from the extinct species. I call attention to these differences in the palate for the reason that both paleontologists and herpetologists

have made much use of these characters in the classification of the turtles, but an examination of a considerable series of recent skulls shows that there is much variation in the palatal structure and that they can not therefore always be relied upon to furnish hard and fast diagnostic characters. The present species can hardly belong to *Graptemys* or *Trachemys* as defined by Hay, and for the present I shall refer it to the genus *Pseudemys*, although the specimen is not entirely in accord with that genus as we understand it to-day. If correct in this assignment it is the most ancient occurrence of *Pseudemys* yet recorded.

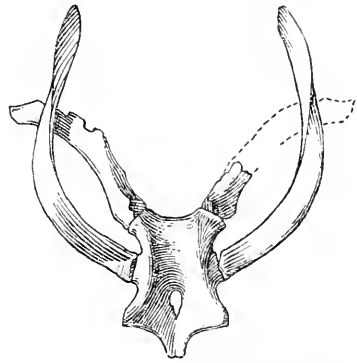
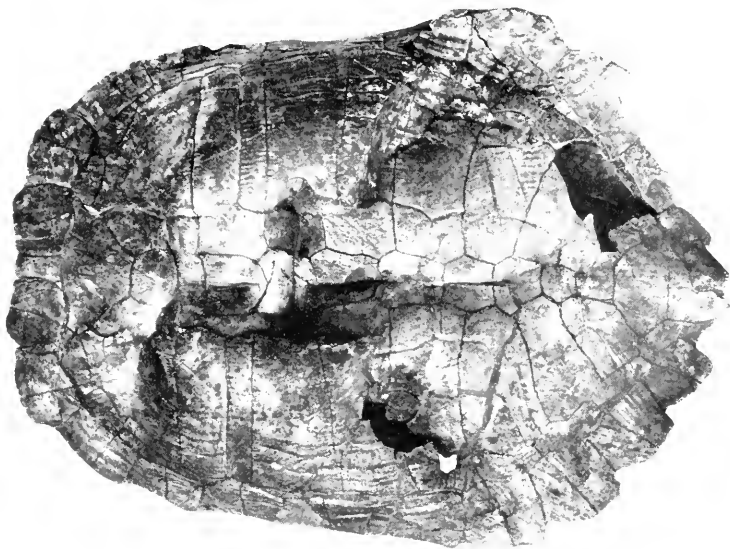
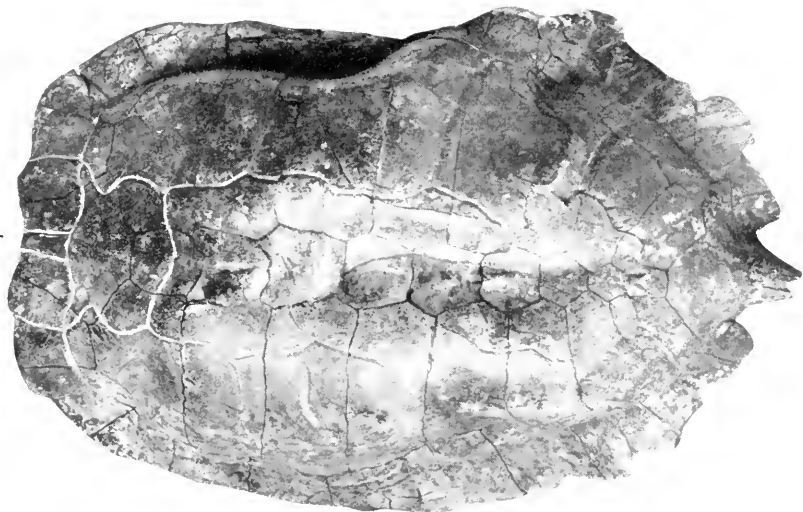


FIGURE 5.—Hyoid of *Pseudemys idahoensis*, U. S. N. M. No. 12059. Type. Superior view. Natural size

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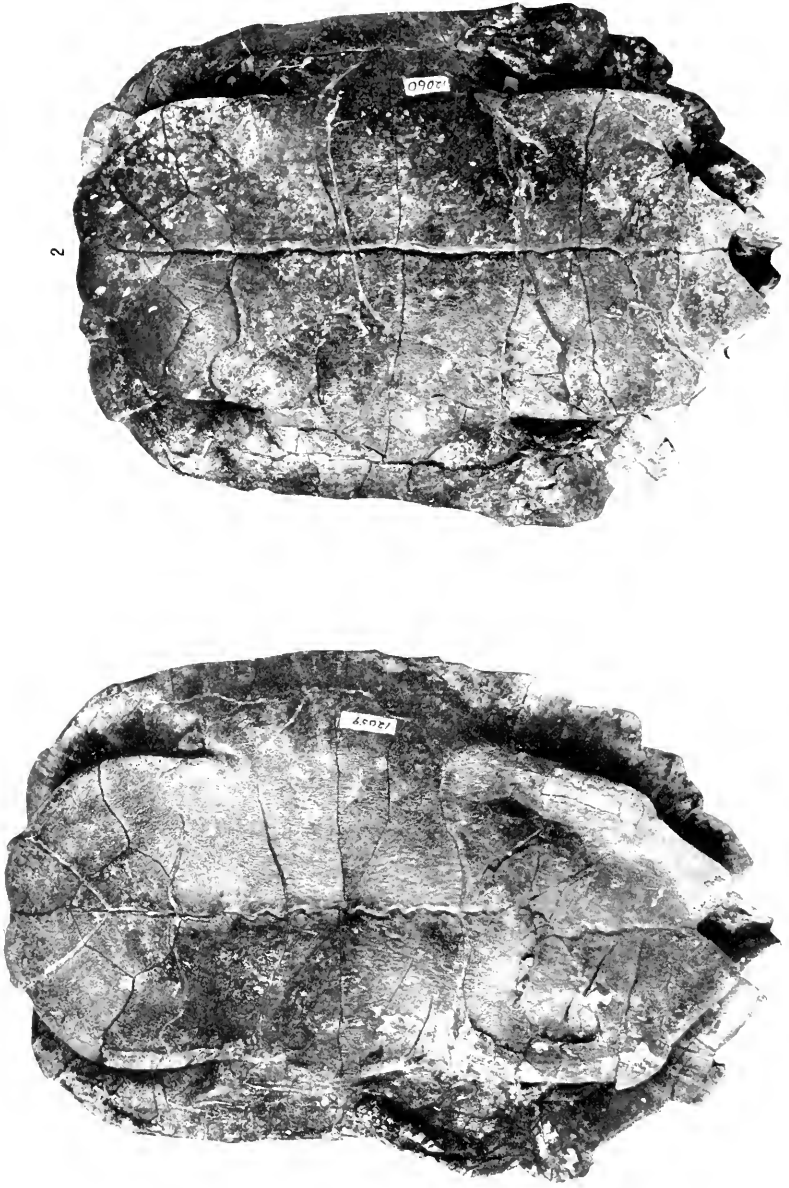


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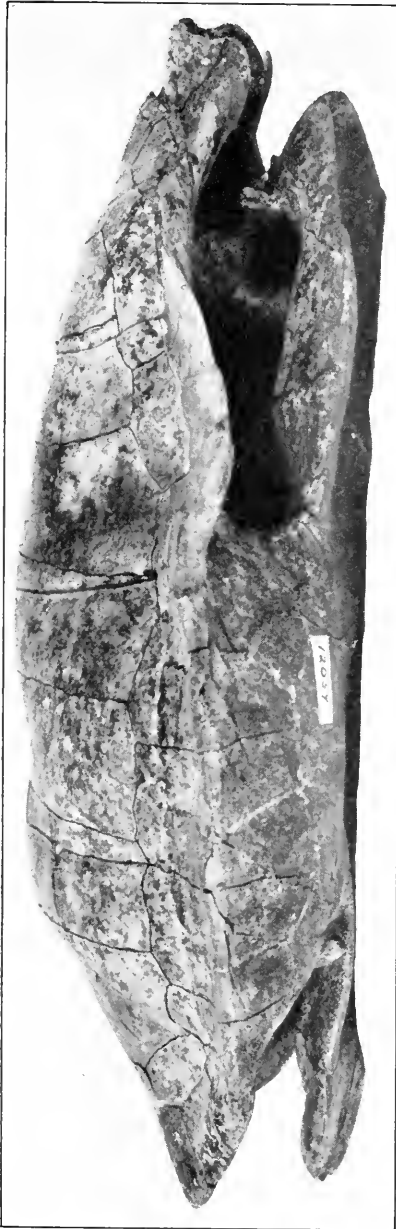


PSEUDEMYIS IDAHOENSIS, NEW SPECIES

1, U.S.N.M. No. 12059. Type. Carapace viewed from above. 2, U.S.N.M. No. 12060. Paratype. Carapace viewed from above. Both about one-third natural size.



PSEUDEMYYS IDAHOENSIS, NEW SPECIES
1, U.S.N.M. No. 12059. Type. Plastron viewed from below. 2, U.S.N.M. No. 12060. Paratype. Plastron viewed from below. Both about one-third natural size.



PSEUDEMYX IDAHOENSIS, NEW SPECIES

U.S.N.M. No. 12059. Type. Shell viewed from the left side. About one-half natural size.

A COLLECTION OF BIRDS FROM GREAT NAMAQUALAND, SOUTHWEST AFRICA

By HERBERT FRIEDMANN

Curator, Division of Birds, United States National Museum

The small collection of birds reported upon in this paper was gathered together by Mrs. L. O. Sordahl while stationed at the astrophysical observatory established by the Smithsonian Institution on Mount Brukkaros, in the Southwest African Protectorate. This mountain, about 5,000 feet in height, is situated a short distance north of Berseba in that part of the protectorate known as Great Namaqualand. (Pl. 1.) Collecting was carried on as time and opportunity permitted on the mountain, along the Fish River near by, and at Berseba.

So little ornithological work has been done in Great Namaqualand in recent years that even a small collection such as the present one reveals many points of interest. Of the 24 forms contained in it, no less than 7 were new to the collections of the United States National Museum, and 2 others were new to science. As far as I have been able to discover, the eggs of *Alario leucolaema* have been taken but rarely, and are thus of interest in adding to knowledge of the breeding season of that bird.

Great Namaqualand is an arid region with rather sparse vegetation, the conspicuous plants being the giant aloes and thorny bushes. The rains come in the summer, and bring in their wake a temporary freshness of vegetation. The breeding season, as far as known, of most of the small birds is in the wet period.

For the loan of specimens in connection with the present study I am indebted to the authorities of the American Museum of Natural History, the Museum of Comparative Zoölogy, and the Academy of Natural Sciences of Philadelphia. The photographs illustrating this paper (pl. 1) are from negatives by W. H. Hoover, of the Division of Radiation and Organisms of the Smithsonian Institution.

Family ANATIDAE, Ducks, Geese, Swans

ANAS ERYTHORHYNCHA Gmelin

Anas erythrorhyncha GMELIN, Syst. Nat., vol. 1, pt. 2, p. 517, 1789 (Cape of Good Hope).

An adult male was shot while swimming in a waterhole in the Fish River, 4 miles from Berseba. It was very fat and was badly damaged by shot.

Family ACCIPITRIDAE, Hawks, Harriers, etc.

MELIERAX MUSICUS MUSICUS (Daudin)

Falco musicus DAUDIN, Traité, vol. 2, p. 116, 1800 [Cape Province (ex Levallant)].

An adult, sex undetermined, was shot by a schoolboy at Keetmanshoop. The feet, the cere, and circumocular area were bright reddish orange.

This bird is of great interest in that it has the cheeks, lores, auriculars, forehead, and lateral borders of the crown nearly black, precisely as in the description of *Melierax poliopterus coombsi* Roberts.¹ The question arises as to whether this bird should be called *coombsi*, which would then have a range extending across South Africa from the northern Transvaal to Southwest Africa (based on only two specimens, each forming one of the present limits of its range), or whether *coombsi* should be looked upon as a melanism of *musicus*, occurring here and there throughout the range of the latter. I prefer to follow the latter course, as it seems unlikely that a black-faced form, *coombsi*, and *musicus* would occur side by side over so great an area.

The other side of the argument is advanced by Roberts, who claims that *musicus* and *poliopterus* are specifically distinct and that *M. poliopterus coombsi* proves this by virtue of the fact that it occurs together with *M. musicus* in the Zoutpansberg district of the Transvaal. It must be admitted that the present specimen may be used to bolster Roberts's thesis, showing how extensively *coombsi* invades the territory of *musicus*, just as legitimately as it has been used here to support the supposition that it is a geographically sporadic melanism.

Roberts writes that *coombsi* has the outer secondaries uniformly dark with white tips and some subapical vermiculations. No such condition is present in the specimen obtained by Mrs. Sordahl.

The bird has the secondaries almost pure white and is therefore probably a male. Its dimensions are as follows: Wing, 345; tail, 225;

¹ Ann. Transvaal Mus., vol. 14, pt. 3, p. 239, 1931 (Montrose Estates, Zoutpansberg).

culmen from the cere (chord), 19; tarsus, 93 mm. The narrow bars on the abdomen are darker than in several birds from Cape Province.

Family FALCONIDAE, Falcons, Caracaras

FALCO TINNUNCULUS RUPICOLUS Daudin

Falco rupicolus DAUDIN, *Traité*, vol. 2, p. 135, 1800 [Cape of Good Hope (ex Levaillant)].

The South African kestrel was very numerous around Mount Brukkaros, where it was usually seen sitting on the tops of the koerkerboum trees, according to Mrs. Sordahl's notes. The birds have a very shrill, screechy cry. Two males were obtained on Mount Brukkaros, one on April 7, 1931, and one on September 30, 1931. The former may really have been a female or else a youngish bird, as it has the head and neck washed with tawny-rufous, and also the rump and upper tail coverts, while in the other bird these areas are grayish. Also the former has the rectrices more heavily barred and the dark marks on the back much broader and more extensive than in the latter.

Roberts² has tentatively referred specimens from 60 miles north of Okahandja to the Rhodesian subspecies *rhodesi*, but in this I think he is mistaken.

Family CHARADRIIDAE, Plovers, Turnstones, etc.

HOPLOPTERUS ARMATUS (Burchell)

Charadrius armatus BURCHELL, *Travels*, vol. 1, p. 501, 1822 (Klaarwater in the Hay district of Cape Province).

A male in good, fresh plumage was shot standing near a pond at Berseba, February 25, 1930.

Family COLUMBIDAE, Pigeons, Doves

COLUMBA GUINEA PHAEONOTUS Gray

Columba phaeonotus G. R. GRAY, *List of specimens of birds in the British Museum*, pt. 4, p. 32, 1856 [South Africa (founded on *Columba trigonigera* Bonaparte, *Conspectus generum avium*, ed. 1, vol. 2, p. 50, 1850)].

A male was shot from a rock ledge on Mount Brukkaros, November 10, 1930. The bare circumocular skin is recorded as bright red in life.

Roberts has recently³ described a pale, bleached grayish race, *bradfieldi*, from Waterberg, Southwest African Protectorate. The present bird should be *bradfieldi* on geographic grounds, but it is

² Ann. Transvaal Mus., vol. 12, pt. 4, p. 304, 1928.

³ Ann. Transvaal Mus., vol. 14, p. 239, 1931.

indistinguishable from *phaeonotus* from the Cape Province. It therefore casts some doubt on the validity of Roberts's form.

Family COLIIDAE, Colies

COLIUS COLIUS (Linnaeus)

Loxia colius LINNAEUS, Syst. Nat., ed. 12, vol. 1, p. 301, 1766 (Cape of Good Hope).

Mrs. Sordahl shot a female in some bushes close by a waterhole near Fish River at Berseba, November 10, 1929, and another female 13 miles southeast of Berseba, February 25, 1931. She found them in flocks of considerable size. Of the bird collected in February she noted that " * * * the skin was grey and black in spots. It was infested with lice, and had parasitic worms in the intestine."

Selater⁴ states that *C. c. damarensis* Reichenow does not appear to be separable. I therefore use a binomial for these specimens.

Family CAPITONIDAE, Barbets

TRICHOLAEMA LEUCOMELAS LEUCOMELAS (Boddaert)

Bucco leucomelas BODDAERT, Table des planches enluminées, p. 43, 1783. [Cape of Good Hope (ex Daubenton, pl. 688, fig. 1)].

Two males were collected at 3,500 feet on Mount Brukkaros on March 13, 1931. Both were sitting in trees in the crater of the mountain and were uttering a series of wheezing notes not unlike those of the American sapsuckers (*Sphyrapicus*).

These two specimens have no spots or streaks on the underparts and are therefore not *T. l. namaqua* of Little Namaqualand. They are both young birds with no red on the forehead, and they lack the toothlike notches on the maxillary tomia. They agree with the description and figure of *T. affine* Shelley, which is the young of *leucomelas*.

In Zululand a race *zuluensis* Roberts occurs, said to be decidedly yellower below than either *leucomelas* or *namaqua*.

Family PYCNONOTIDAE, Bulbuls

PYCNONOTUS NIGRICANS NIGRICANS (Vieillot)

Turdus nigricans VIEILLOT, Nouveau dictionnaire d'histoire naturelle, vol. 20, p. 253, 1818 [banks of the Orange River in Namaqualand (ex Levaillant)].

Two males were obtained at Berseba, one on July 24, 1930, and one on October 6, 1930. Another male was collected 6 miles from Berseba on March 1, 1931. The eyes were recorded as bright red

⁴ Systema avium Ethiopicarum, pt. 1, p. 266, 1924.

with black pupils, the rim around the eye like a circle of orange beads. Mrs. Sordahl found the song to be similar to that of the western meadowlark of North America (*Sturnella neglecta*).

The specimens are in worn plumage.

Family TURDIDAE, Thrushes

OENANTHE MONTICOLA MONTICOLA Vieillot

Oenanthe monticola VIEILLOT. Nouveau dictionnaire d'histoire naturelle, vol. 21, p. 434, 1818 (Namaqualand, ex Levallant, pl. 184).

A male and a female were obtained on Mount Brukkaros (at 5,000 feet) on July 22, 1931. The birds were seen hopping along on the rocks together and were apparently a mated pair. Mrs. Sordahl wrote in her notebook that “* * * these birds stay around the mountain all year. They vary in color; the males have a white bar of feathers on the shoulders of the wings. Some males have white on under tail coverts and lower half of ventral side, but some have white only around base of tail. Their call is a *chirrup*, *chirrup* when hopping on the ground. When sitting on posts or wires or flying they have a lovely musical song that is long and warbling and includes a whole scale of notes.”

The male is in the somewhat gray-headed plumage with white upper wing coverts, white rump and upper tail coverts, and white abdomen, but with black (white-bordered) under tail coverts.

CERCOMELA FAMILIARIS GALTONI (Strickland)

Erythropygia galtoni STRICKLAND, in Jardine's Contributions to Ornithology, 1852, p. 147 (Damaraland).

A male was collected at Fish River, 6 miles from Berseba on March 1, 1931. Mrs. Sordahl writes that this species travels in large flocks, and she assumes that, as she never saw it before at a waterhole, the species was probably passing through on migration at the time the specimen was taken.

Recently, Roberts⁵ has described a race, *damarensis*, from Windhoek, which is said to differ from *galtoni* in having the throat pale brownish and only the abdomen and under tail coverts whitish instead of the entire underparts yellowish white as in the latter form. He states that the actual type locality of *galtoni* is Swakopmund, which would make *galtoni* a lowland coastal bird and *damarensis* a form of the higher interior. On this basis the present specimen might be expected to be of the latter race. Unfortunately the specimen is in worn plumage and somewhat stained, but there is

⁵ Ann. Transvaal Mus., vol. 14, pt. 3, pp. 242-243, 1931.

certainly no increasing paleness from the throat to the abdomen as would seem to be the case in *damarensis* from Roberts's description. However, I have no topotypical material of either *galtoni* or *damarensis* for comparison.

The bird shows signs of molt in the wings.

ACROCEPHALUS BAETICATUS BAETICATUS (Vieillot)

Sylvia baticata VIEILLOT, Nouveau dictionnaire d'histoire naturelle, vol. 11, p. 195, 1817 (South Africa, ex Levaillant, pl. 121, fig. 2).

A male was collected in bushy undergrowth at Fish River, 6 miles from Berseba, on March 1, 1931. It has a scolding song, according to Mrs. Sordahl's notes.

ERYTHROPYGIA CORYPHEUS ABBOTI Friedmann

Erythropygia coryphaeus abboti FRIEDMANN, Proc. Biol. Soc. Washington, vol. 45, p. 65, Apr. 2, 1932 (Fish River, 6 miles from Berseba, Southwest African Protectorate).

Abbot's ground robin is known only from two specimens collected by Mrs. Sordahl at the type locality, March 1, 1931. As stated in the original description, it differs from the nominate form in having much smaller white tips on the outer rectrices.

One of the two specimens is unsexed, the other is a female, but as Mrs. Sordahl found them together in a tree with two half-grown young and considered them a mated pair, it is very probable that the unsexed bird is a male. Both specimens are in abraded plumage.

Family SYLVIIDAE, Old World Warblers

CISTICOLA SUBRUFICAPILLA NAMAQUA Lynes

Cisticola subruficapilla namaqua LYNES, Ibis, suppl., Oct., 1930, p. 216 (Klipfontein, Little Namaqualand).

Two specimens were obtained at 4,000 feet on Mount Brukkaros, an unsexed bird on June 29, 1930, and a male on July 20, 1930.

Mrs. Sordahl observed this grass-warbler dodging in and out among the low bushes of the mountain side. She records the call as a sharp, short note.

The unsexed bird is small and is probably a female. The dimensions of the two specimens are as follows (the first figure in each case refers to the male): Wing, 58, 51; tail, 58 (molting), 53.5; culmen from base, 11, 10.5 mm.

These two specimens constitute a notable northward extension of the known range of this bird, which was previously recorded only

from the Orange River south to the Olifants River. It is possible that they may be of an undescribed race, as the male is larger than the figures given by Lynes for *namaqua* (wing 51, tail 48 mm).

PRINIA FLAVICANS (Vieillot)

Sylvia flavicans VIEILLOT, Encyclopédie méthodique, vol. 2, p. 438, 1820 (South Africa; Namaqualand, ex Levaillant).

On February 24, 1931, an adult female and a partly fledged young bird were collected at Fish River; an unsexed adult was taken at the same place on March 1, 1931; and an adult male was shot there on November 10, 1929. Several others were seen but not collected.

Mrs. Sordahl writes that this bird has a scolding, chattering song.

The juvenal bird has no dark pectoral band and is paler yellow on the underparts than the adults. The female attending the young one shows signs of molt in the wings and tail.

Family MUSCICAPIDAE, Old World Flycatchers

PARISOMA LAYARDI Hartlaub

Parisoma layardi HARTLAUB, Ibis, 1862, p. 147 (Zwartland, Malmesbury District).

Mrs. Sordahl shot a male Layard's tit-babbler on Mount Brukkaros, on January 18, 1931. The bird was found in a dry waste at the foot of the mountain (3,200 feet) close to the desert.

The specimen is in worn plumage. This is the first example of this species to come to the United States National Museum.

BATIS PRIRIT (Vieillot)

Muscicapa pririt VIEILLOT, Nouveau dictionnaire d'histoire naturelle, vol. 21, p. 486, 1818 (Lower Orange River, ex Levaillant).

Three specimens of the pririt flycatcher were collected on Mount Brukkaros—a female on January 18, 1931, and a "male" (really a female) and a female on March 22, 1931. Mrs. Sordahl found these birds flitting about in the bushes and small trees on the arid slopes of Mount Brukkaros.

The birds are all in worn plumage and were badly damaged by the shot.

Roberts⁶ has recorded a nest found on October 12 at "Quickborn," 60 miles north of Okahandja, by R. D. Bradfield.

⁶ Ann. Transvaal Mus., vol. 12, pt. 4, p. 310, 1928.

Family LANIIDAE, Shrikes

LANIUS COLLARIS SUBCORONATUS Smith

Lanius subcoronatus A. SMITH, Illustrations of the zoology of South Africa, pl. 68, 1841 (Latakoo).

A female was collected at Fish River, 6 miles from Berseba, on March 1, 1931. Mrs. Sordahl found it perching " * * * in a tree that was thickly populated with insects."

The specimen is a young one molting into adult plumage.

TELOPHORUS ZEYLONUS PHANUS (Hartert)

Pelicius zeylonus phanus HARTERT, Nov. Zool., vol. 27, p. 451, 1920 (Farta Bay, near Benguella Town).

Mrs. Sordahl collected an adult male 20 miles from Keetmanshoop, on September 10, 1931. Her notes on this shrike are as follows: " Found hopping among the bushes in a dry creek bed, eating insects. This bird had a huge grasshopper in its mouth when I shot it. They fly in pairs. When resting in the bushes, first one calls and the other answers. They do not warble or sing. Their call is a whistle of many notes. The whistle is exactly like a human being's whistle, and if one did not see the bird one would think it was a person whistling."

In the original description of *phanus*, which is a pale-backed race, Hartert writes that " * * * probably a third form inhabits Namaqualand, as a male and female collected by C. B. Grant in May and July, 1903, at an elevation of 3,104 feet, appear to have the flanks and sides of breast much more widely ashy grey, and are a little smaller. More material will probably lead to the establishment of a third form." I have seen no Angolan birds (typical *phanus*) and so can not say whether the present specimen, which, on the grounds of its pale-green back as compared with a series of typical *zeylonus*, is definitely *phanus*, differs from Benguella birds in the coloration of the flanks and sides. I find no appreciable size difference between it and South African birds (*zeylonus*), and, since Hartert found none between Angolan and South African examples, I assume it to be similar in size to typical *phanus*. It does have the gray color of the sides and flanks very extensively developed, but is matched in this regard by two Cape Province examples. Its dimensions are as follows: Wing, 95; tail, 96.5; culmen from base, 23 mm. In my opinion it would be unwise to describe a third form on such slender evidence.

This specimen extends the known range of *phanus* far to the south and upsets the distribution given by Selater⁷ who records *phanus*

⁷ Systema avium Ethiopicarum, pt. 1. p. 634, 1924.

only from the coastlands of southern Angola, and *zeylonus* from as far north as Damaraland. The Damaraland and Namaqualand birds, if not distinct, should be considered as *phanus*. Roberts⁸ has identified birds from Swakopmund as *phanus*, and I think he is quite right in so doing.

Family STURNIDAE, Starlings

ONYCHOGNATHUS NABOUROUP NABOUROUP (Daudin)

Sturnus nabouroup DAUDIN, Traité d'ornithologie, vol. 2, p. 308, 1800 (Kamiesberg, Little Namaqualand, ex Levaillant, pl. 89).

Mrs. Sordahl collected an adult female at 5,000 feet on Mount Brukkaros on January 15, 1931. She noted that the iris was bright orange with a black pupil. She found this starling always in pairs and recorded the song as a musical utterance "something like the meadow lark" (*Sturnella*).

The specimen collected is in a molting condition in the wings.

In Damaraland and southern Angola a race, *benguellensis*, with the light areas on the rectrices pure white, replaces *nabouroup*.

Family NECTARINIIDAE, Sun-birds

CHALCOMITRA FUSCA (Vieillot)

Cinnyris fuscus VIEILLOT, Nouveau dictionnaire d'histoire naturelle, vol. 31, p. 506, 1819. (Great Namaqualand, ex Levaillant, pl. 296).

Mrs. Sordahl collected six specimens of the dusky sun-bird, as follows: Male, Fish River, 13 miles from Berseba, February 25, 1930; 4 males, 1 female, Mount Brukkaros, January 18–August 31, 1931. Males taken in January and February are in breeding plumage; males taken in July and August are in the white-bellied plumage with the breast and center of throat black.

In January these sun-birds were found in large numbers in the trees and low bushes in the dry scrubby areas at the foot of Mount Brukkaros (3,500 feet); also up to 5,000 feet on the slopes.

Of one of the nonbreeding males, collected August 31, Mrs. Sordahl writes: " * * * first seen fluttering against window pane of house, then flew to a tiny bush and pecked at some seeds, then flew to water fountain. Its tongue was 21 mm long and had a split of 3 mm on the end of it." The body fat of two of the birds is recorded as being bright orange in color.

⁸ Ann. Transvaal Mus., vol. 12, pt. 4, p. 310, 1928.

Family PLOCEIDAE, Weaver-finches

PASSER MELANURUS DAMARENSIS Reichenow

Passer arcuatus damarensis REICHENOW, Orn. Monatsb., vol. 10, p. 77, 1902 (Damaraland; type in Berlin Museum from Windhuk).

One "female" (really a male by plumage) was collected at Berseba, 3,000 feet, July 24, 1930. Mrs. Sordahl writes that these "* * *" birds are found around the buildings and trees and chicken yards of Berseba the whole year."

The Damara race of the Cape sparrow is distinguished by its lighter rufous back and upper wing coverts and its deeper, purer black crown, cheeks, chin, and throat and breast patch. The specimen collected is in fresh plumage and constitutes a form new to the national collections.

Family FRINGILLIDAE, Grosbeaks, Finches, Buntings

ALARIO LEUCOLAEMA Sharpe

Alario leucolaema SHARPE, Bull. Brit. Orn. Club, vol. 13, p. 80, 1903 (Great Namaqualand; type in Brit. Museum from Hountop River).

Two males and one female were collected on Mount Brukkaros on March 22, 1931, while on April 5, 1931, a female and her nest and three eggs were taken in the same place. The first three birds were shot in bushes near a small stagnant pool in the crater of the mountain at an altitude of 4,500 feet. One of the males had its mouth full of grass seeds. The song is recorded as "*pwei pwei*, but when we came close to them the warning note was a sharper *peep peep*."

On April 5, the female bird, collected with the nest, was found perching in a tuft of grass at 4,500 feet on the mountainside. It flew away when approached to within 5 feet. Mrs. Sordahl examined the tuft of grass and found a tiny nest with three very pale bluish-white eggs sparsely speckled with reddish brown at the larger pole. "The bird flew to a near-by bush and kept up a sharp note of *peep peep-peep peep*, or *pey pey*, the note rising on the end of the second *peep*. The nest was well hidden by the grass tops and would never have been detected if the bird had not flown out."

One of the eggs was broken in transit to the museum; the others are in perfect condition. They measure 18 by 13.5 and 18 by 13 mm, respectively.

The nest is a very compact, deep cup made of grasses, plant fibers, and fine straws outside, well lined with cottony plant fibers inside. The inside dimensions are: Depth, 30; diameter, 45 mm; outside: Depth, 48; diameter, 70 mm.

The status of *leucolaema* has been an unsettled question for many years. Sharpe described the white-throated birds as a species; Shelley and others considered them merely the winter plumage of the black-throated *Alario alario*; still others looked upon *leucolaema* as the immature males of *alario*. The present series, including the white-throated adult males taken within two weeks of the finding of a nest with eggs, conclusively does away with Shelley's contention that *leucolaema* is the winter plumage of *alario*. Also the fact that they are adults (with hard, firmly ossified skulls) shows that *leucolaema* can not be the young stage of *alario*. The two are certainly distinct—so distinct that I consider them full species as did Sharpe, and not subspecies as does Sclater.⁹ In a case like this, where a genus contains only two forms, it is not particularly necessary to call them conspecific in order to emphasize their relationship.

The two males reveal considerable variation in color; one has a larger and deeper black patch on the breast and on the crown and occiput; the former is also darker rufous above—deep hazel—while the latter is tawny-cinnamon. The females are alike in color. The dimensions of the present birds are as follows: Males: Wing, 67.5, 65; tail, 45, 43; culmen from base, 9.5, 9.5; females: Wing, 63, 64; tail, 43, 44; culmen from base, 9, 9 mm, respectively.

POLIOSPIZA ALBOGULARIS SORDAHLAE Friedmann

Poliospiza albogularis sordahlae FRIEDMANN, Proc. Biol. Soc. Washington, vol. 45, pp. 65, 66, Apr. 2, 1932 (Mount Brukkaros, Southwest Africa).

Mrs. Sordahl obtained two specimens of this long and relatively slender-billed race of *Poliospiza albogularis*. Both are in worn plumage.

Mrs. Sordahl writes that “* * * these birds stay on the mountain during the whole year, living on top of the mountain during the hottest months, November, December, January, and February. During the cool months * * * also found at the lower levels and on the foothills below the mountain.” She often saw the birds in flocks in the large tree aloes, apparently eating the seeds. A bird bath and drinking fountain set up near the house was frequented also, as many as 30 birds at one time being counted on it.

A male from Van Rynsdorp, Cape Province, collected by de Schauensee, approaches *sordahlae* in the bill character, but has a shorter wing.

⁹ *Systema avium Aethiopicarum*, pt. 2. p. 818, 1930.

FRINGILLARIA IMPETUANI (Smith)

Emberiza impetuani A. SMITH, Report on expedition for exploring central Africa, etc., p. 48, 1836 (between Nu-Gariep and the Tropic, that is, Bechuanaland).

Two males and one female were collected on Mount Brukkaros on March 22, 1931. Mrs. Sordahl saw several of these rock buntings eating grass seeds and drinking water from a little pool in the crater of the mountain.

These specimens are in rather abraded plumage. Four similarly worn examples from Cape Province are distinctly more rufous, especially on the head and back. The two groups of specimens appear to be separable subspecifically, but in the absence of topotypical *impetuani* from Bechuanaland, I can not tell which one of the two groups is the new one. Four birds from the Kasai district, southern Belgian Congo, agree better with birds from Cape Province than from Great Namaqualand. The Mount Brukkaros birds may be characterized as gray headed and gray naped in contrast to all the others examined. Two females from Etosha Pan and from Kalkveldt, Southwest Africa, are more brownish than the Mount Brukkaros birds, but are more grayish than South African or Katangan specimens seen.

Since this paper was first written, de Schauensee¹⁰ has published on this species and finds the present specimens less grayish than one from Etosha Pan, more like typical *impetuani*.

¹⁰ Proc. Acad. Nat. Sci. Philadelphia, vol. 84, p. 202, 1932.



MOUNT BRUKKAROS FROM A DISTANCE OF ABOUT 8 MILES

The village shown is Berseba.



CLOSER VIEW OF MOUNT BRUKKAROS

Showing the nature of the environment.

FIVE NEW SPECIES OF NORTH AMERICAN ICHNEUMON-FLIES

By FRANK D. DEGANT

Cleveland, Ohio

The new species of ichneumon-flies described herein are from collections made by the writer in the United States and Canada during the summer of 1931. All type and allotype specimens are deposited in the United States National Museum, as are also two paratypes of *Panargyrops insula* and two of *Polysphincta venatrix*. Two paratypes of *Panargyrops insula* are deposited in the Academy of Natural Sciences of Philadelphia. All other specimens are in the collection of the writer. In describing the specimens a binocular microscope with a total magnification of $102\times$ was used.

The kindness of R. A. Cushman, of the United States Bureau of Entomology, in comparing the specimens described with material in the National Museum and in criticizing the manuscript, is sincerely appreciated.

AMBLYTELES OHIOENSIS, new species

A small, robust species near to *A. brevicinctor* Say, but distinguished from that species by the thinness of the head anteroposteriorly and by the size.

Female.—Length 9 mm. Body, except where specified below, strongly punctate. Antennae 33-jointed, stout and flat beneath on apical half. Ovipositor extending beyond the apex of abdomen. Head thin anteroposteriorly; face produced, wider than long; clypeus polished in center, slightly depressed, broadly truncate at apex, malar space longer than basal width of mandibles; temples broad, equal to short diameter of eyes, flat, sharply receding; diameter of an ocellus two-thirds of ocellocular line, vertex higher than eyes, slightly granular between the eyes and ocelli. Notauli obsolete; scutellum broad, polished, and impunctate, margined at base, the groove smooth. Propodeal carinae strong, areola smooth and impunctate. Abdomen broad, first tergite widened at apex, second tergite longer than wide, thyridia oblique, placed near posterior edge of gastrocoeli, which are strongly defined. Legs stout, front femora swollen, slightly longer than the tibiae, hind basitarsus longer than

the three following joints combined, front tibiae crowned with stout spines at apex. Wings long, stigma narrow, areolet rhomboid, second recurrent beyond the middle.

Black; mandibles and tegulae at base reddish testaceous; first tergite at apex and second at base and apex reddish; annulus on antennae, spot on superior orbits, scutellum, and apex of abdomen white. Legs black; fore tibiae in front white; all tarsi fusco-testaceous; wings hyaline, slightly infumated.

Male.—Aside from the secondary sexual characters, differs as follows: Mandibles black; face at sides, spot on each side of clypeus, one on cheeks, collar, tegulae, spot before and below, fifth tergite at apex, femora at apex, the tibiae and tarsi of fore and middle legs in front white; red on abdomen confined to spot on apex of first tergite.

Type locality.—Bedford, Ohio.

Type.—U.S.N.M. No. 44125.

Remarks.—Described from one female and two males collected at type locality on September 12, 1931, by the writer.

PANARGYROPS INSULA, new species

From all described North American species of this genus this species can be separated by its partly red abdomen.

Female.—Length 5–6 mm, anterior wings 4 mm, antennae 22-jointed in type, first joint of flagellum longer than second, second and third equal. Ovipositor as long as the first three segments of the abdomen. Head transverse, somewhat thick anteroposteriorly, smooth and shining; clothed with long, glittering pubescence, which is longer on the face; clypeus convex, smooth, and impunctate, separated laterally, anterior edge thin, rounded, and with two indistinct nipples, the foramina distinct; face broader than long; malar space two-thirds as long as basal width of mandibles, finely granular; temples broad, somewhat arcuately receding, wider than cheeks; vertex convex, higher than the eyes; ocelli small, their diameter less than one-third the length of the ocellular line, median ocellus equidistant from antennae and eyes; ocelloccipital line longer than ocellular line. Mesoscutum polished, slightly longer than wide; notauli distinct, foveolate, converging posteriorly, and ending wide apart just before the scutellar groove; scutellum convex, polished, and densely pubescent laterally; mesopleurum polished, sternaulus narrow and foveolate. Propodeum short, strongly rounded, rugulose, densely pubescent, carinae present, but irregularly defined; spiracles small and round, placed in a smooth area near the base. Legs long and slender, posterior calcaria short, equal in length to the fifth tarsal joint; third tarsal joint equal in length to fourth and fifth joints combined. First abdominal segment long, curved, the dorsal carinae reaching nearly to the apex, the spiracles placed

near the middle; postpetiole slightly wider than petiole, smooth at apex; second tergite with a slight depression at base, less than one-third as wide at base as at apex; third tergite slightly constricted at base. Wings hyaline, veins and stigma dark; submedian cell equal to, or slightly shorter than, median; discocubitus broken, without a ramellus; length of radial cell on metacarpus about one-half longer than stigma; nervellus broken far below the middle; subdiscoidiella obsolete.

Black, palpi stramineous; scape, base of first flagellar joint, mandibles except at apex, tegulae, and a spot at apex of postpetiole reddish testaceous; legs ferruginous, the front and middle tibiae paler, the front tarsi stramineous, the middle tarsi infusate apically, and the hind tibiae and tarsi fuscous.

Male.—Essentially like the female aside from the secondary sexual characters.

Type locality.—Parr Island, East Spence Lake, Ontario, Canada.¹

Type.—U.S.N.M. No. 44126.

Remarks.—Described from many specimens collected by the writer at type locality on July 6, 1931. Paratype B, female and male, is deposited in the Academy of Natural Sciences of Philadelphia.

The host of this species should be easily ascertained, as *P. insula* will be found working on a very small plant that grows among the pebbles near the water.

EXOLYTUS MELANOSCELIS, new species

Near to *E. ithacae* Ashmead in having the frons transversely striate, but distinguished from that species by the black legs.

Female.—Length 14 mm, antennae 25-jointed, first joint longer than second, second longer than third; ovipositor 1 mm. Head subquadrate, face produced, with a small tubercle below antennae, covered with long hairs; clypeus short, sparsely punctate, rounded and polished at apex; malar space two-thirds basal width of mandibles; temples broad, convex, about equal to short diameter of eye; eyes ovate; diameter of an ocellus about one-third ocellocular line. Notauli defined anteriorly; mesoscutum smooth, polished, slightly punctate anteriorly; scutellar groove crenulate, scutellum slightly convex, triangular, margined to middle; mesopleurum smooth, polished, longitudinally striate above the coxae, prepectal carinae strongly defined, ending at subalar tubercle; sternaulus deep, crenulate. Metapleurum punctate; propodeum long, extending to middle of hind coxae, gradually sloping from base to apex, carinae prominent, areola smooth, polished, the portion beyond transversely striate, which with the longitudinal carinae forms a reticulation at

¹ Parr Island, comprising about 12 acres, lies south of Picton, Ontario, in East Spence Lake.

apical sides. First abdominal segment long, nearly round, slightly broadening from spiracles to apex, postpetiole smooth and polished, its disk slightly convex and with three minute foveae forming a triangle between the spiracles; abdomen beyond smooth and polished, second abdominal segment one-half as wide at base as at apex, with an oblique groove laterally at base; third abdominal segment slightly wider at base than at apex, subequal in length to the second. Legs of medium length, hind basitarsus equal in length to the four following joints combined. Stigma triangular, radius at middle, length of marginal cell on metacarpus twice the stigma, nervulus interstitial, postnervulus broken at middle, areolet open behind; nervellus vertical, broken below the middle, the first abscissa of radiella equal to the first abscissa of cubitella in length, first abscissa of mediella strongly curved, obliterated at base.

Black; palpi whitish; mandibles brownish; abdomen beyond the spiracles of the first segment ferruginous; legs black, front femora and base of middle femora brownish; front and middle tibiae and tarsi testaceous; wing hyaline.

Type locality.—Hinckley, Ohio.

Type.—U.S.N.M. No. 44127.

Remarks.—Described from one female collected by the writer at type locality on August 30, 1931.

POLYSPHINCTA (POLYSPHINCTA) VENATRIX, new species

A robust species. In color and sculpture of propodeum near to *P. burgessi* Cresson, but distinct from that species in its larger eyes and ocelli, shorter malar space, and sculptured abdomen.

Female.—Length 9 mm, ovipositor 3 mm, anterior wings 5.05 mm. Head transverse, smooth, and sparsely punctate, clothed with long hairs on the sides of face and mandibles. Face longer than wide, produced below antennae; clypeus convex, rounded at apex, its anterior edge somewhat depressed; foveo-ocular line longer than the malar space, which is one-third as long as basal width of mandibles; eyes large, slightly converging toward clypeus, slightly emarginate opposite the antennae; temples rounded, their width equal to about two-thirds of the short diameter of the eye; diameter of a lateral ocellus greater than ocellocular line, which is about equal to postocellar line and about one-half the ocelloccipital line; occipital and hypostomal carinae well developed; notauli distinct, subparallel, ending in a subquadrate, punctate area at middle of mesoscutum; scutellum convex, margined at base only; mesopleura smooth and impunctate, the furrow very wide, punctiform at base; propodeum rugulose, the median carinae defined and ending at the top of the posterior declivity; a short, strong median carina at

apex; metapleura smooth and polished; first tergite rugulose, the median carinae reaching nearly to apex; second to sixth tergites strongly tuberculate, the impressions well defined and rugulose, the sculpture gradually lessening beyond the fourth; the apices polished in center, somewhat coriaceous laterally; legs of medium length, the hind basitarsus equal in length to the three following joints combined; wings long, stigma very narrow, first intercubitus more than one-half the length of the second abscissa of cubitus, postnervulus broken well below the middle; nervellus broken slightly below the middle.

Black; antennae, clypeus, and mandibles brownish; palpi, tegulae, the apices of all trochanters and femora except the posterior, all tibiae on the outside except the posterior at apex, and the first three joints of the middle and hind tarsi, except at apex, white; hind femora and tibiae at apex, the latter beneath, the apices of the first three and the whole of the fourth and fifth tarsal joints of middle and hind legs fuscous; legs otherwise reddish; wings hyaline, veins dark, costal margins pale.

Type locality.—Parr Island, East Spence Lake, Ontario, Canada.

Type.—U.S.N.M. No. 44128.

Remarks.—Described from three females as follows: Type and paratype A, collected by the writer at type locality on July 6, 1931; paratype B, in the United States National Museum, collected at Oswego, N. Y., on June 27, 1896. Paratype B has much more red on the body than the type and paratype A, but the inconsistency of color in this genus, with this specimen's consistency in structure with the type, leaves little doubt as to its identity.

LATHROLESTES VISSCHERI, new species

Different from all described North American species of *Lathrolestes* in its size and in the venation of wings, and from *L. nasoni* Davis, with which it may be confused, in the red abdomen in both sexes and larger claspers in the male. The species of this genus are not common, and their host relationship, I believe, is unknown. The shape of the ovipositor, which is incised beneath at apex, combined with its obtuse point, offers no suggestion.

Female.—Length 7 mm. Antennae 34-jointed in type. Ovipositor exerted and as long as the apical truncature of abdomen. Head transverse; temples bulging, somewhat more so than the cheeks; face broader than long and slightly produced below antennae, the interantennal line nearly equal to the apical width of mandibles; clypeus wide, convex, broadly rounded and with long hairs at apex, the foramina distinct; malar space one-half basal width of mandibles; vertex slightly raised, extending posteriorly, about the di-

ameter of an ocellus, behind the ocelli, thence sharply declivous to occiput; diameter of an ocellus about one-half ocellocular line; first joint of flagellum slightly longer than second, constricted at base; notauli defined only anteriorly; mesoscutum distinctly convex, though slightly flattened in posterior middle; scutellum triangular in outline, slightly raised, truncate at base, the basal edge indistinctly, transversely striate; mesopleurum smooth, finely punctate; propodeum strongly granular, the pleural and apical carinae distinct, other carinae entirely absent. First abdominal segment rather long, gradually broadening toward apex, the lateral foveae large and near the base, the tergite granularly opaque except at extreme base, where it is polished; second and third tergites much broader than long, depressed. Legs long; in the hind legs the coxae nearly as long as the first abdominal segment, the calcaria as long as the third tarsal joint, the first tarsal joint as long as the three following joints combined. Nervulus interstitial, the discocubitus abruptly curved, giving the second discoidal cell a subquadrangular appearance; postnervulus broken slightly above the middle, areolet oblique, quadrangular; intercubitella about one-half as long as the basal abscissa of radiella, nervellus slightly reclivous, broken below the middle.

Black; head except middle of frons, vertex, and upper part of occiput flavo-ferruginous; antennae brownish above, paler beneath; tegulae whitish; abdomen beyond the first segment ferruginous, slightly darker on second segment and apex; mandibles, palpi, front coxae and trochanters stramineous; legs largely reddish testaceous with front and middle legs paler; wings hyaline.

Male.—Except for secondary sexual characters and the following differences in color, essentially like female: Antennae at base beneath, clypeus, mandibles except at apex, median line on front, cheeks, palpi, and entire orbits whitish; prothorax except collar, tegulae, a small spot on mesonotum above the humeral angle, mesopleurum below the groove, sternum, and a spot before the hind coxae rufo-flavescent.

Type locality.—Parr Island, East Spence Lake, Ontario, Canada.

Type.—U.S.N.M. No. 44129.

Remarks.—Described from five males and two females captured by the writer at the type locality on July 6, 1931, and named for Dr. J. Paul Visscher, of Western Reserve University. The type pair taken in copula. Paratype A, male and female, somewhat darker in color.

FOSSIL PLANTS FROM THE ASPEN SHALE OF SOUTHWESTERN WYOMING¹

By ROLAND W. BROWN
United States Geological Survey

Until recently no fossils other than fish scales, lingulas, and bones² have been reported from the Aspen shale of southwestern Wyoming. In 1931, Reeside and Weymouth³ described a number of ammonites and pelecypods from this shale, but the first hint of the presence of fossil plants in the Aspen was given in a personal communication, May 17, 1930, by A. Allen Weymouth, of the California Company, Denver. In the latter part of June, 1930, W. H. Bradley, of the United States Geological Survey, and I visited the locality cited by Mr. Weymouth and made a good collection, which forms the basis for this paper.

The locality mentioned is northwest of Kemmerer, Wyo., in the NW. $\frac{1}{4}$ sec. 6, T. 24 N., R. 115 W., in the low bluff on the south side of the junction of Everly Creek and Fontanelle Creek and about 125 feet east of a north-south fence. The section of the Aspen shale exposed in this region is about 1,000 feet thick. It shows strata of black and gray shales, clay, thin coals, bentonite, gray sandstone, and light-colored tuff, all dipping 35° westward. The gray to bluish-gray shales weather into long rounded hills with a distinctive greenish-gray appearance. This was the only locality in the Aspen at which we found fossil plants.

The fossil plants occur in the uppermost 125 feet of the formation in a thin stratum of bluish-gray hard mudstone, which is very brittle and fractures conchoidally. The plants occur at all angles through the matrix, making it somewhat difficult to get entire specimens. They are very well preserved and stand out black against the bluish-gray background.

The Aspen flora occurs in deposits which directly underlie the Frontier formation of accepted Colorado age and are, therefore, somewhat earlier, but still Colorado in age. These two floras, there-

¹ Published by permission of the Director, U. S. Geological Survey.

² Schultz, Alfred R., *Geology and geography of a portion of Lincoln County, Wyo.* U. S. Geol. Surv. Bull. 543, p. 59, 1914.

³ Reeside, John B., jr., and Weymouth, A. Allen, *Mollusks from the Aspen shale (Cretaceous) of southwestern Wyoming.* Proc. U. S. Nat. Mus., vol. 78, art. 17, pp. 1-24, pls. 1-4, 1931.

fore, become important as marking definite stratigraphic horizons. When a sufficient number of such cases come to light, the history of plant species and their migrations can be studied, thereby making identification of new or isolated collections easy and reliable.

The flora with which the Aspen would immediately be compared is that described by Knowlton⁴ from the overlying Frontier formation. The lists of the two floras are arranged side by side below:

Aspen flora	Frontier flora
<p><i>Anemia fremonti</i> Knowlton. <i>Asplenium occidentale</i> Knowlton. <i>Cladophlebis readi</i>, new species. <i>Microtaenia paucifolia</i> (Hall) Knowlton. <i>Sparganium aspensis</i>, new species. <i>Populus? aspensis</i>, new species. <i>Dryandroides lanceolata</i> Knowlton. <i>Laurus aspensis</i>, new species. <i>Sassafras bradleyi</i>, new species. <i>Nelumbo weymouthi</i>, new species. <i>Liquidambar fontanella</i>, new species. <i>Prunus aspensis</i>, new species. <i>Staphylea? fremonti</i> Knowlton. <i>Sapindopsis schultzi</i>, new species.</p>	<p><i>Anemia fremonti</i> Knowlton. <i>Asplenium occidentale</i> Knowlton. <i>Dennstaedtia? fremonti</i> (Hall) Knowlton. <i>Dryopteris coloradensis</i> Knowlton. <i>Microtaenia paucifolia</i> (Hall) Knowlton. <i>Microtaenia variabilis</i> Knowlton. <i>Tapcinidium? undulatum</i> (Hall) Knowlton. <i>Equisetum</i> sp. <i>Smilax? coloradensis</i> Knowlton. <i>Myrica nervosa</i> Knowlton. <i>Salix cumberlandensis</i> Knowlton. <i>Salix frontiersensis</i> Knowlton. <i>Quercus stantoni</i> Knowlton. <i>Ficus fremonti</i> Knowlton. <i>Ficus? sp.</i> <i>Ficus? sp.</i> <i>Cinnamomum hesperium</i> Knowlton. <i>Cinnamomum? sp.</i> <i>Dryandroides lanceolata</i> Knowlton. <i>Aralia vatchii</i> Knowlton. <i>Staphylea? fremonti</i> Knowlton. <i>Dewalquea pulchella</i> Knowlton. <i>Phyllites ficifolia</i> Knowlton. <i>Phyllites dentata</i> Knowlton. <i>Phyllites.</i></p>

It will be seen that five species are common to both floras, which is a large percentage when the small size of the floras is considered. So far as the general composition of the floras is concerned, they are very similar and, in my opinion, indicate the same climatic and environmental conditions, namely, a warm temperate and well-watered habitat. Knowlton argues for a tropical or subtropical habitat for the Frontier flora on the basis of several ferns supposed to be related to those now living in such an environment, and on a few species of supposed figs. Studying Knowlton's discussion of the davallioid

⁴ Knowlton, F. H., A fossil flora from the Frontier formation of southwestern Wyoming. U. S. Geol. Surv. Prof. Paper 108, 1917.

ferns, one gets the impression that none of these is definitely determined in terms of living species, and two are assigned to a new genus. Their value, therefore, as habitat indicators is not very great. As for the supposed figs, the fact that two of these species are questioned and the third is identified on the basis of resemblance to another problematical *Ficus*, one can be pardoned for not placing great stress on their value as habitat indicators.

Opposed to all the uncertainties due to doubtful identification are a few determinations which come reasonably within the limits of certainty. The Aspen species which seem to me to be correctly assigned and beyond serious question are: *Nelumbo weymouthi*, *Liquidambar fontanella*, and *Sassafras bradleyi*. If *Liquidambar fontanella* alone is correct and if it had the habits of the living species, it would stamp the association as a temperate, perhaps a warm-temperate, one.

The absence from the Aspen of gymnosperms like the cycads and conifers leaves little for comparison with such older floras as that of the Potomac group, the Kootenai formation, and others. Besides *Sassafras bradleyi* and *Laurus aspensis* there are few resemblances to anything in the large and somewhat earlier flora of the Dakota formation. Likewise there are few if any points in common with such floras of later date as that of the Mesaverde formation, Judith River formation, Vermejo formation, and others. The Aspen and Frontier floras, therefore, hold a conspicuous place in the gap of our knowledge of western interior Cretaceous vegetation.

PTERIDOPHYTA

ANEMIA FREMONTI Knowlton

PLATE 1, FIGURE 3

Anemia fremonti KNOWLTON, U. S. Geol. Surv. Prof. Paper 108, p. 84, pl. 31, fig. 6; pl. 32, figs. 1-3, 1917.

The specimen figured here is similar to those described by Knowlton. Exception could be made in respect to the smaller size and the deeper lobing of the pinnules of the Aspen material; but these characters may well come within the variations of the species.

Plesiotype.—U.S.N.M. No. 39136.

ASPLENIUM OCCIDENTALE Knowlton

PLATE 1, FIGURE 5

Asplenium occidentale KNOWLTON, U. S. Geol. Surv. Prof. Paper 108, p. 84, pl. 31, figs. 2-5, 1917.

The specimen figured here is apparently a ternately divided portion of a young or deformed frond of the species described by Knowl-

ton. The pinnules are not elongated as in Knowlton's specimens, but the venation and marginal dentition are similar.

Plesiotype.—U.S.N.M. No. 39137.

CLADOPHLEBIS READI, new species

PLATE 1, FIGURE 2

This was probably a tree fern, if stoutness of the rachis is any indication of the size and habit of these ancient ferns. The rachis is 3.5 mm in diameter and bears narrow, elongated pinnae at intervals of 1.3 cm. The pinnae average 10 cm in length and bear numerous closely spaced, falcate, minutely stalked or sessile pinnules. The margin of the pinnules appears for the most part to be entire, but in some cases is noticeably crenulate. From the midrib of the pinnules emerge 8 to 10 pairs of secondary veins, which fork once close to the midrib. No sori are present on any of the specimens in this collection.

Many species of *Cladophlebis* have been described from Cretaceous rocks. The species which this most resembles is *Cladophlebis distans* Fontaine⁵ from the Potomac group of Virginia and Maryland. The chief difference between the two seems to be that most of the pinnules of *C. readi* are conspicuously rounded at the base and are attached by a minute stalk. *C. readi* will no doubt be compared with *Dryopteris coloradensis* Knowlton.⁶ That species, however, has more widely spaced pinnae; the venation of the pinnules is more open and oblique; and the rachis is much slenderer, suggesting a different habit. I name this species for my colleague, C. B. Read.

Holotype.—U.S.N.M. No. 39138.

MICROTAENIA PAUCIFOLIA (Hall) Knowlton

PLATE 1, FIGURE 4

Microtaenia paucifolia (HALL) KNOWLTON, U. S. Geol. Surv. Prof. Paper 108, p. 82, pl. 30, figs. 1, 2, 1917.

The specimen figured is fragmentary, but sufficient is present to identify it with those described by Knowlton.

Plesiotype.—U.S.N.M. No. 39139.

SPARGANIACEAE

SPARGANIUM ASPENSIS, new species

PLATE 2, FIGURE 2

This specimen has the general appearance of a *Sparganium* spike of staminate flowers. The portion preserved is 9 cm long and shows

⁵ Fontaine, W. M., The Potomac or younger Mesozoic flora. U. S. Geol. Surv. Mon. 15, p. 77, pl. 13, figs. 4, 5, 1890.

⁶ Knowlton, F. H., A fossil flora from the Frontier formation of southwestern Wyoming. U. S. Geol. Surv. Prof. Paper 108, p. 83, pl. 30, figs. 3, 4, 1917.

small staminate heads at intervals of 1 cm. The individual stamens can not be distinguished readily. Associated with these flowers on other blocks are portions of narrow striated leaves, which closely resemble the leaves of modern sparganiums.

The object with which this fossil may at once be compared is that described by Lesquereux ⁷ from the Dakota sandstone of Kansas, and called by him flowers of *Platanus primaeva*. Associated with these flowers are undoubted *Platanus* leaves, so that the identification of the flowers as *Platanus* flowers may be correct. On the other hand, there are objects in the Dakota group described as *Podozamites* which may be *Sparganium* leaves instead. I have found no *Platanus* leaves in the Aspen collection, where they certainly should have left fossil leaf remains if *Platanus* had been a tree along the Aspen river courses.

Holotype.—U.S.N.M. No. 39140.

SALICACEAE

POPULUS? ASPENSIS, new species

FIGURE 1

The single specimen of this species (fig. 1) is the only one in this collection. It is fragmentary but enough is preserved to show the general characters. The leaf was orbicular, probably 6 cm in diameter, with few large

blunt teeth on the margin and a cuneate base. From the top of the petiole arises a palmate system of primary veins, which curve upward toward the margin and send off secondaries toward the teeth. The finer venation is obscure. The petiole is 2.5 cm long.

In general this leaf resembles those forms from the Fort Union described as *Populus*, particularly *P. cuneata* Newberry, and illustrated by Ward.⁸ The teeth in the present specimen are coarser,

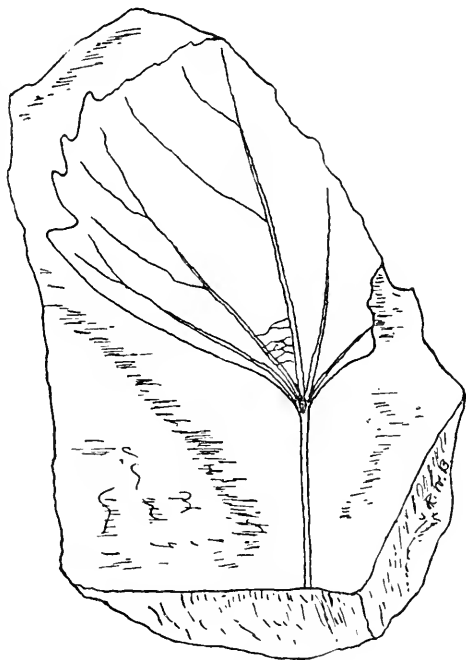


FIGURE 1.—Sketch of *Populus? aspensis*. ×1

⁷ Lesquereux, Leo, The flora of the Dakota group. U. S. Geol. Surv. Mon. 17, p. 72, pl. 8, figs. 8, Sb, 1892.

⁸ Ward, L. F., Types of the Laramie flora. U. S. Geol. Surv. Bull. 37, p. 19, pl. 4, figs. 5-8; pl. 5, figs. 1-3, 1887.

and because of the difference in age I venture the opinion that this is a different and perhaps an ancestral species.

The resemblance of these leaves to those of the modern genus *Grewia* of the Tiliaceae has led some paleobotanists to think their affinities may lie in that direction. I have, therefore, questioned the generic reference to *Populus*.

Holotype.—U.S.N.M. No. 39141.

PROTEACEAE

DRYANDROIDES LANCEOLATA Knowlton

PLATE 1, FIGURE 6

Dryandroides lanceolata KNOWLTON, U. S. Geol. Surv. Prof. Paper 108, p. 89, pl. 34, fig. 7, 1917.

This lanceolate coriaceous coarsely toothed leaf, although somewhat smaller, has the characters of that described by Knowlton from the Frontier formation. It is comparable to the leaves of some modern species of such proteaceous genera as *Dryandra* and *Banksia*. However, in the absence of more certain evidence than foliar characters, no definite commitment other than that already suggested by Knowlton can be made as to generic affinity.

*Plesio*type.—U.S.N.M. No. 39142.

LAURACEAE

LAURUS ASPENSIS, new species

PLATE 2, FIGURE 1

This specimen is a short stem bearing one nearly entire leaf, a portion of another leaf, and the petiole of a third. There are no buds or leaf scars on the stem. The large leaf is 8 cm long and 2.5 cm wide, and is oblanceolate in form, the nature of the apex being unknown, but the base is cuneate to a petiole 1.5 cm long. Margin entire. The venation is pinnate from a strong midrib, and is composed of 12 or more subopposite pairs of secondaries, which emerge from the midrib at 50°, run out fairly straight to within a short distance of the margin, and then curve upward sharply and become lost near the margin beneath the curve of the secondary above. The tertiary venation is a system of irregular parallel diagonals connecting the secondaries.

It would seem that the affinities of this specimen are with the Lauraceae or Magnoliaceae. I have compared the specimen with all the available similar material in the United States National Museum, but find no exact reliable correspondence for definite iden-

tification in terms of past work. I venture, therefore, to name a new species, with the reservations necessitated by all such paleobotanic uncertainties.

Holotype.—U.S.N.M. No. 39143.

SASSAFRAS BRADLEYI, new species

PLATE 2, FIGURE 5

Only one specimen of this species was found. It is an obtusely trilobate leaf 5 cm long and 5 cm wide from tip to tip of the lateral lobes. The upper margin of the lateral lobes makes an approximately right-angle sinus with the margin of the middle lobe. Margin entire and noticeably thickened. Petiole of unknown length. The two lateral primaries arise from a point 3 cm above the top of the petiole and spread to the apices of the lobes. A few widely spaced secondaries arise at angles of 55° and curve upward to the margin, where they are lost in the thin vein, which arises at the base of the leaf and runs along the margin, giving it a thickened appearance. A secondary arises from the midrib and runs to the sinus where it forks, these forks in turn joining the marginal vein.

This leaf differs somewhat from modern sassafras leaves in having such unusually wide sinuses, but compares well in regard to internal structure. The chief difficulty here, it seems to me, is not whether this leaf ought to be called sassafras but just how it should be distinguished from many variable Cretaceous forms from the Dakota sandstone, Cheyenne sandstone, and elsewhere, called *Sassafras*, *Sterculia*, and *Aralia*.

No fruits of any kind were found in this collection and, therefore, an important source of evidence as to the affinity of these leaves is not at hand.

I take pleasure in naming this species for W. H. Bradley, of the United States Geological Survey.

Holotype.—U.S.N.M. No. 39144.

NYMPHAEACEAE

NELUMBO WEYMOUTHII, new species

PLATE 1, FIGURE 1

Only the central portion of this leaf is preserved, so that it is impossible to state exactly the size and shape of the entire leaf. There are 12 strong radiating primaries, some of which fork within a centimeter of the center and produce toward the margin the characteristic venation network of *Nelumbo*. Evidently the leaf was not large, possibly 6 to 8 cm in diameter, and was probably orbicular in shape.

This species appears to be different in size and venation from any other Cretaceous *Nelumbo*. The distribution and general relationships of the fossil nelumbos have been discussed by Berry.⁹ I name this species for A. Allen Weymouth.

Holotype.—U.S.N.M. No. 39145.

HAMAMELIDACEAE

LIQUIDAMBAR FONTANELLA, new species

FIGURE 2; PLATE 2, FIGURE 3

The fragments of leaves in this collection would lead one to infer that all the leaves of this species were deeply and narrowly 3-lobed. The range of variation in modern liquidambar includes 3- to 7-lobed

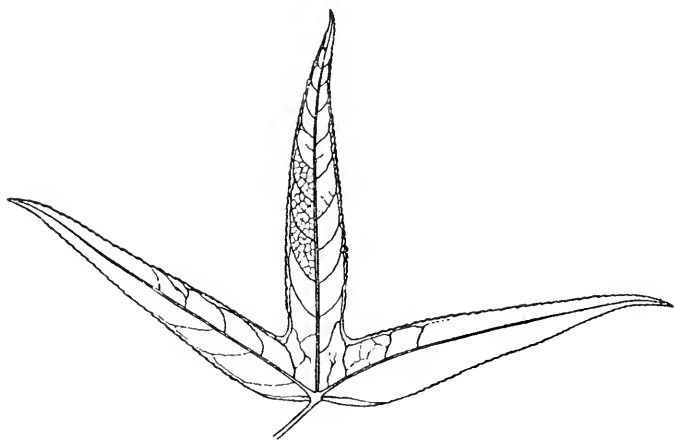


FIGURE 2.—Reconstruction of *Liquidambar fontanella*. $\times \frac{1}{2}$

leaves with the 5-lobed leaf the usual and most common form. The over-all breadth of this leaf from tip to tip of the lower lobes is 13 cm and the length from the top of the petiole to the tip of the middle lobe is 8 cm. The lobes are 1 cm wide near the base and become narrowly attenuate to their tips. The margins are finely crenate-serrate. The base is slightly cordate. Length of petiole unknown.

The primary venation includes three strong veins arising from the top of the petiole, the laterals diverging at an angle of 60° from the middle vein. Eight to ten pairs of secondaries appropriately spaced branch off from the primaries at approximately 60° , loop upward near the margin, and connect with the secondaries above. In general the characters of this leaf compare well with those of the modern

⁹ Berry, Edward W., Geologic history of the Wilcox group at Meridian, Miss. U. S. Geol. Surv. Prof. Paper 108, p. 64, 1918.

liquidambar, with the exception of the unusually long lobes and the restricted area of the basal region. From an esthetic point of view the tree which bore these delicately graceful leaves was undoubtedly a striking object in the Cretaceous landscape along the river courses and moist low country of southwestern Wyoming.

A review of liquidambar history discloses no earlier undoubted liquidambar than this. Several Cretaceous leaves have been called liquidambers, but because they have entire margins they are not now regarded as such. Not until Eocene and Miocene times did the liquidambers leave plentiful remains both of leaves and fruits.

Holotype.—U.S.N.M. No. 39146.

ROSACEAE

PRUNUS ASPENSIS, new species

PLATE 2, FIGURE 4

This is an oblong to lanceolate leaf with finely serrate margin, rounded base, and short petiole. Nature of the apex unknown. Approximate length 5 cm, width 2 cm. The venation is not clearly shown, but is pinnate with secondaries emerging from the midrib at 50° and becoming camptodrome near the margin. Finer venation undeterminable. The affinities of this leaf seem to me to be with the Rosaceae and I assign it to the genus *Prunus*. There are no Cretaceous species of *Prunus* so far as I know with which this could be identified.

Holotype.—U.S.N.M. No. 39147.

STAPHYLEACEAE

STAPHYLEA? FREMONTI Knowlton

PLATE 1, FIGURE 8

Staphylea? fremonti KNOWLTON, U. S. Geol. Surv. Prof. Paper 108, p. 93, pl. 32, figs. 4, 5; pl. 33, fig. 5, 1917.

The specimen figured here and the only one of the sort in this collection is at least a trifoliate leaf, but may be the terminal portion of a leaf which had more leaflets. Points of difference between this specimen and those figured by Knowlton are: Petiole of middle leaflet longer than those of the laterals; base of leaflets rounder; secondary veins less numerous. All these differences may be within the limits of variation in the species, and, therefore, I hesitate to designate a new species for this specimen from the Aspen formation. The question mark following the generic name, it seems to me, is much to the point.

Plesiotype.—U.S.N.M. No. 39148.

SAPINDACEAE

SAPINDOPSIS SCHULTZI, new species

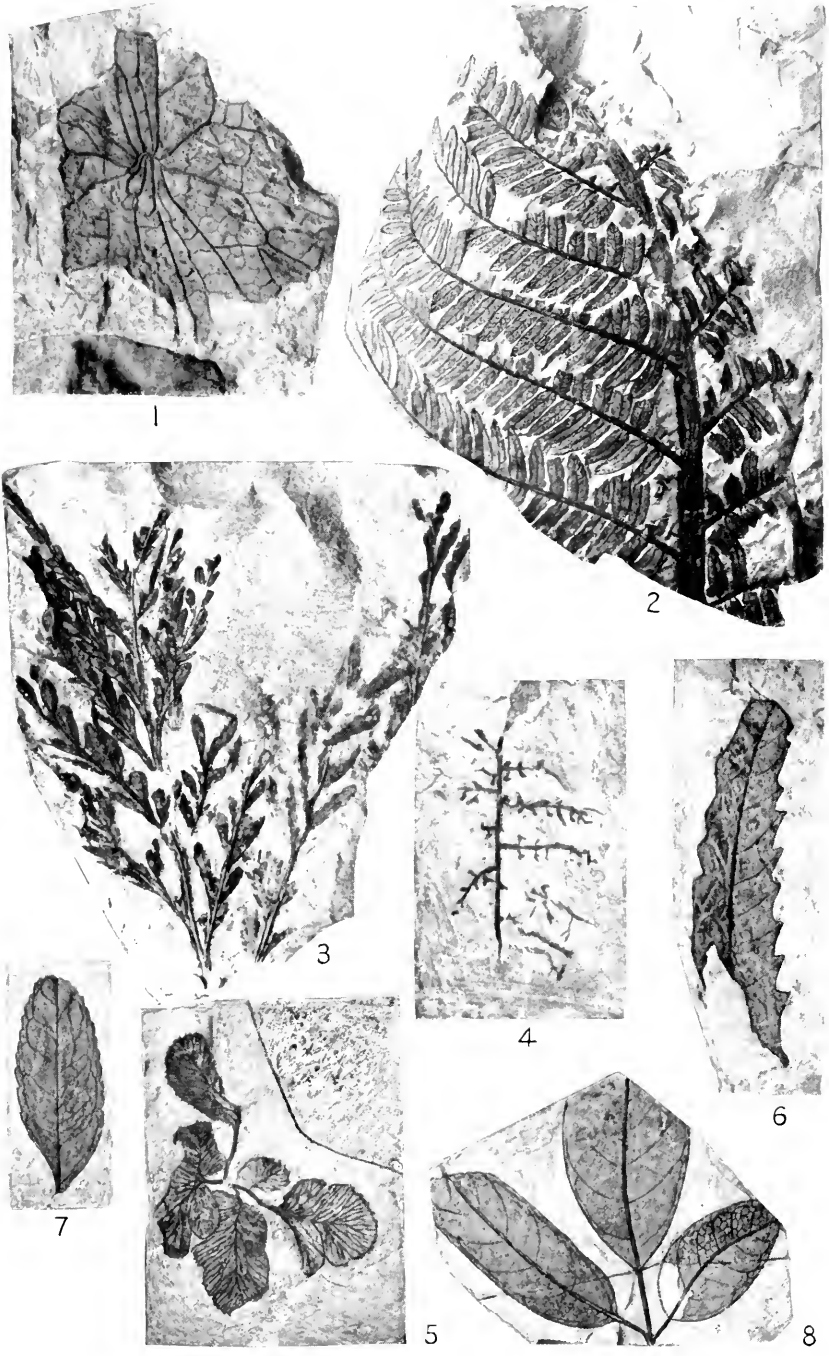
PLATE 1, FIGURE 7

The specimen reproduced here was apparently a leaflet of a compound leaf as inferred from its markedly unequal base and from the fact that on another block in this collection are fragments of four such leaflets all oriented in the same direction and about equally spaced as if they had been attached to a rachis. Unfortunately the rock is broken off at that line, leaving this inference unproved. The leaflet is elliptic in form, with low crenate-serrate teeth on the margin and an inequilateral base. Length 3 cm, width 1.2 cm. The venation is pinnate with five or six pairs of secondaries emerging from the midrib at 60° , looping upward well within the margin to the secondary above. Finer venation obscure.

Following a precedent in regard to indefinite Cretaceous Sapindaceae, I venture to assign this species to *Sapindopsis*, because of its resemblance to *S. belviderensis* Berry.¹⁰ That species, however, is larger, with coarsely toothed margins. I name this species for A. R. Schultz.

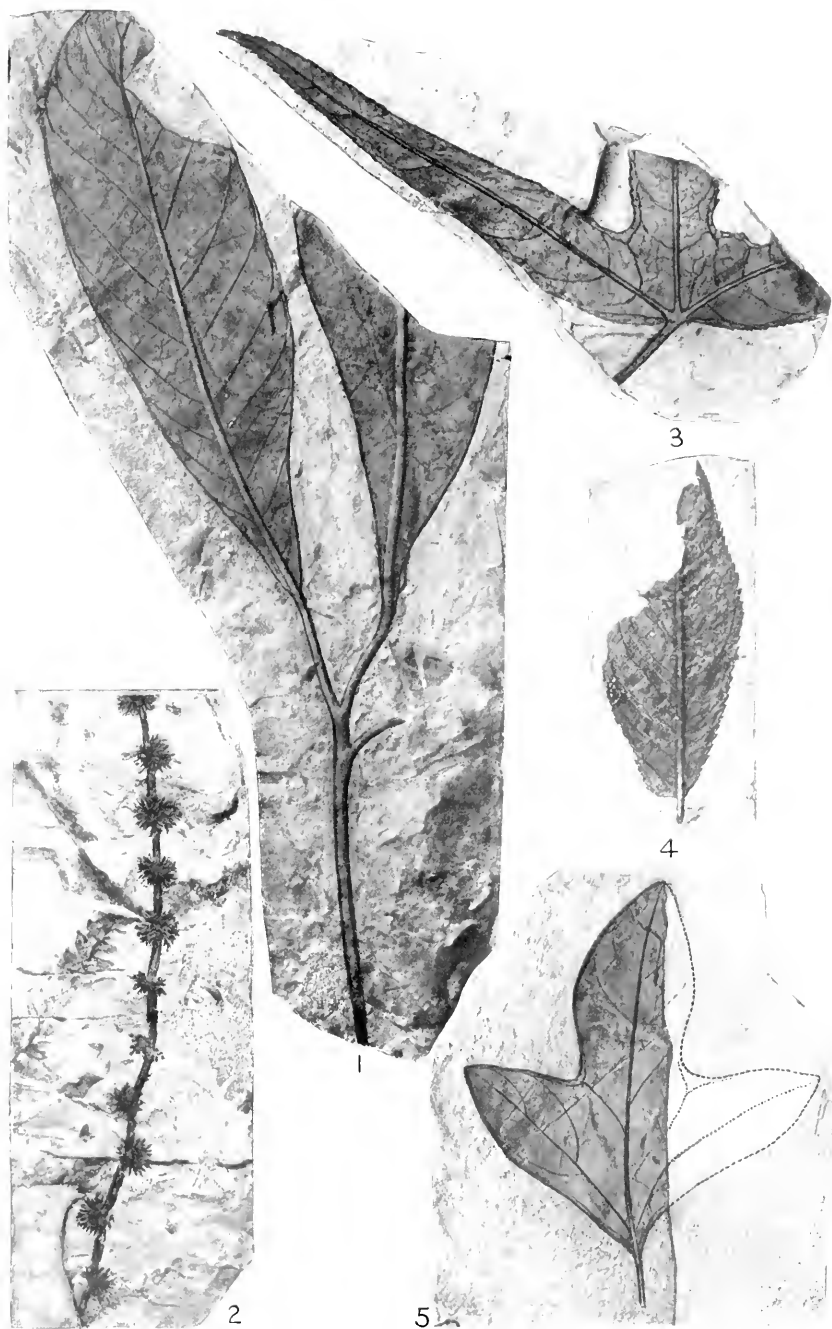
Holotype.—U.S.N.M. No. 39149.

¹⁰Berry, Edward W., Flora of the Cheyenne sandstone of Kansas. U. S. Geol. Surv. Prof. Paper 129, p. 216, pls. 49-54, 1922.



FOSSIL PLANTS FROM SOUTHWESTERN WYOMING

1, *Nelumbo reynoldsi*, new species; 2, *Cladophlebis scadi*, new species; 3, *Anomia tremonti* Knowlton; 4, *Microtaenia paucifolia* (Hall) Knowlton; 5, *Asplenium occidentale* Knowlton; 6, *Degandroides lanceolata* Knowlton; 7, *Sapindopsis schultzi*, new species; 8, *Staphylea? tremonti* Knowlton. All natural size



FOSSIL PLANTS FROM SOUTHWESTERN WYOMING

1, *Laurus aspensis*, new species; 2, *Spartanium aspensis*, new species; 3, *Liquidambar fontuella*, new species; 4, *Prunus aspensis*, new species; 5, *Sassafras bradleyi*, new species. All natural size.

CAMPTOSTROMA, A LOWER CAMBRIAN FLOATING HYDROZOAN

By RUDOLF RUEDEMANN

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A problematic fossil from the Lower Cambrian of Pennsylvania, belonging to the United States National Museum, has been submitted to me for study and description. The material consists of molds only, one specimen showing impressions of the two opposite sides, two others impressions of one side. The incompleteness of the preservation would at first sight discourage a study of the form, but its great age and perplexing appearance invite examination, and the sharpness of the casts permits some fairly conclusive determinations.

The outline of the fossil is broadly elliptic to subcircular, the supposed upper surface slightly convex with a shallow central depression, the supposed under surface flat or slightly concave. The organism was originally either disklike or lenticular—perhaps even a spherical body, the degree of post-mortem compression not being determinable in the fossil state. It is probable that the body was biconvex and relatively soft, as the oblique compression has made a concentric semicircular fold on what I consider the upper surface, with a corresponding ridge on the underside. (See fig. 1.)

No trace of the original substance of the organism is preserved, but a limonite film in the holotype and a silica film in another specimen, between the matrix and the mold of the fossil, suggest the presence of a periderm. The sharp impressions of both upper and under surfaces leave no doubt of the substantial character of the walls and indicate the presence of a surficial skeleton composed of loosely connected spicules, forming the coenenchym. The spicules may have been chitinous in substance, or they may have contained some lime, the form then being comparable to some recent Alcyonacea, as the Xenidae, the spicules of which also contain but a relatively small proportion of lime, or to the Alcyoniidae, in whose soft, fleshy colonies the spicules are not fused.

The fossil suggests at first sight an echinoderm, but the absence of a distinctly plated integument and of mouth and anus is adverse to that view. Neither can a reference to the sponges, which might be suggested by the composition of the body wall of spicules and the presence of numerous openings (possibly inhalant pores), be upheld.

There is nothing to indicate the presence of an ostium, and such organs as the monticules also distinguish it from the sponges. Likewise the possibility that this peculiar form might be referable to the Receptaculidae, now considered by some as calcareous algae, is not supported, as the fossil lacks the regular surficial pavement of quin-cuncial elements so characteristic of those problematical organisms.

All the features of the fossil considered, a reference to the hydrozoans appears most apt. The strange *Paropsonema cryptophya* Clarke from the Naples beds of New York is at once suggested, having in common with our fossil the general outline, possible disk-like shape, and concentric ring of radial ribs. *Paropsonema* is now considered as the float or pneumatophore of a large hydrozoan, which in structure resembles the float of *Porpita*. (See Ruedemann, 1916, p. 22.) Another similar fossil is the Ordovician *Discophyllum peltatum* Walcott, considered as a medusa by Walcott but also referred by Ruedemann (*ibid.*) to the Hydrozoa as a probable float of *Siphonophora*. Both *Paropsonema* and *Discophyllum*, while strikingly similar to *Camptostroma* in general features, possess characters that unite them with *Porpita* but that are not found in *Camptostroma*. *Paropsonema* shows distinct cycles of air chambers and concentric lines, while *Camptostroma*, in the cancellated skeleton and the monticules, possesses characters that are not found, to my knowledge, in any floats of siphonophores but that point distinctly to the Tubulariae.

The central portion of the disklike body on one (upper?) side is marked with numerous large subcircular depressions sunk into a granular surface from which, in some places, faint radiating depressed lines extend, suggesting the astrorhizae of the stromatoporoids. The granular surface in one specimen results from small, closely packed spicules. This area is surrounded by a ring of sharp folds or ribs, the spicules of which are coarser and less closely packed than in the central portion, leaving numerous pores between. These spicules are intermediate between those of the upper central area, the marginal area, and the underside. The ribs fade into the marginal portion and underside, both of which are characterized by a polygonal network of small, widely spaced, vertical, platelike spicules. As a result of this plate arrangement the whole looks like the vermicular, perforate sclerenchyma of numerous stromatoporoids or more recent Hydrocorallinae. In some areas a pavement of short pillarlike spicules appears. The underside is characterized by numerous monticules with depressed centers showing groups of small circular pits and nodes surrounded by radiating trabeculae or tubes (?).

The general form of the bodies, as well as the structure of the cancellated surface of the coenosarc and the monticules, suggesting

zooidal tubes with an interior reticulate columella, finds its closest homology in the Tubulariae, such as the genera *Stoliczkania* and *Heterastridium* from the Triassic of Europe and Asia. In a somewhat less degree they resemble the Paleozoic Stromatoporoidea, which are currently placed with the Hydrocorallinae and Tubulariae as an early aberrant order, and which are able to form colonial stocks and possess surfaces similar to those of *Camptostroma*.

From both the Hydrocorallinae and Stromatoporoidea this form is separated by its obvious lack of a strongly calcareous coenenchym, although it is quite possible that the zooids of *Camptostroma* had a chitinous periderm and a chitinous, or only slightly calcified, basal coenenchym, as in many recent Tubulariae. The presence of the limonite film in the holotype and of the siliceous film in another specimen between the matrix and the impression of the fossil makes it probable that the polyp stocks were protected by a chitinous outer layer (periderm) as in many recent Tubulariae, and the mold we see is that of the chitinous or slightly calcareous skeleton secreted at the base of the outer layer of zooids or polyps.

From the sharp preservation of the surface features (of the last coenenchym), loss of all interior structure, and the clear evidence of a considerable flexibility and compressibility of the body, I am led to the conclusion that this organism had a chitinous skeleton and resembled most of the present Tubulariae. It may well have been the ancestor of the Stromatoporoidea, which later developed much greater expansion of the coral stocks, which necessitated protection and support by deposition of lime in the skeleton.

As the colonial stock was lenticular if not subspherical, and there is evidence of the presence of only one layer of coenenchym underlying the youngest generation of zooids, it is possible that the earlier and deeper layers of the coenenchym were not preserved, owing to a lack or small percentage of chitin and lime; or it is possible that they were dissolved on further growth and the interior then filled partly with gas (perhaps contained in the mesogloea) and the entire hydrosome was floating. This is by no means improbable for the following reasons: There are floating pelagic colonial stocks or hydrosomes of hydrozoans to-day, as in the family Pelagohydridae and three species of the genus *Margelopsis* (see Hickson, 1909, p. 274). The presence of hydropores on both the upper and under sides of the colonial stock indicates freedom for the zooids to expand on all sides, or a free floating condition of the hydrosome, while the lightness and imperfect development of the skeleton point in the same direction. Finally, there is little doubt among biologists that the mobile habit preceded the sessile and the discovery of the ocean bottom. In the case of this colonial stock, budding would then

have preceded fixation, while the reverse is generally presumed to have happened. (See Raymond, 1921, p. 347.) In the present case, however, the coenenchym layer and the float provided the stratum of fixation for the succeeding generations of zooids, thereby allowing the development of budding. It seems quite logical that this should have been a stage preceding that of discovery of and fixation on the ocean bottom. (See the opposite view of Alexander Agassiz below.) The gradual or accidental sinking of such colonial stocks to a favorable bottom would have provided the transitional stage from the floating colonial stock to the fixed one.

Camptostroma is then to be regarded as an early hydrozoan that had not yet progressed from the pelagic habit to the bottom (benthonic) habit, and was still in the first stages of developing a chitinous (or mucine ?) skeleton.

I have before emphasized on the one hand the striking similarity in outline and coarser sculpture (the ribs) of the disks here described to the floats of the siphonophores, as represented by the recent *Porpita*, the Devonian *Paropsonema*, and possibly the Middle Ordovician *Discophyllum*; and, on the other hand, the close homology of the details of the skeleton of the disk with those of the coenenchym of the Tubulariae. It is of great importance that leading authorities on the Hydrozoa, as Kölliker, Louis Agassiz, McCrady, and Alexander Agassiz (1881, p. 10), have pointed out that the relationship of the Velellidae and Porpitiidae to the tubularian hydroids is very close. Agassiz describes very fully how *Porpita* might be derived from a Hydractinia, or *Podocoryne* "in which the chitinous extension of the base of the coenosarc may perhaps be considered as the first indication of the formation of the float" (*op. cit.* pp. 10, 11). He goes even further in indicating the homologies in the zooids of the Tubulariae and the Siphonophora mentioned and (*op. cit.* p. 12) in pointing also to the close relationship of *Porpita* to the Hydrocorallinae, the singular white plate of the float, and its peculiar structure reminding him of the porous structure of the corallum of Sporadopora, Allopora, and Millepora, and finally even in mentioning the Stromatopora, which, if related to Millepora, would carry back the hydrozoans to the Silurian. Summarizing these observations, it seems safe for us to consider *Camptostroma* as a tubularian hydrozoan with relations to the Siphonophora on one hand and the Paleozoic Stromatoporoidea on the other, to the ancestors of all of which it may stand in close relation through its generalized character. It is to be remembered that tubularian Hydrozoa and Siphonophora apparently were already present in Lower Cambrian time.¹

¹ I have recently described (1931, p. 2) a Middle Cambrian hydrozoan (*Chaunograptus scandens*) of the campanularid type (order Calyptoblastea).

CAMPTOSTROMA,² new genus

Lenticular or spheroidal bodies with chitinous or slightly calcareous skeleton present in only one surficial layer. One (upper?) surface has central circular area with granular surface, and short, subcircular, zooidal tubes, surrounded by primitive astrorhizae. Central area surrounded by a concentric ring of radiating ribs with granular surface. Remaining surface composed of reticulate meshwork of platelike spicules surrounding round pores and larger monticules, with central groups of pores and knobs.

Genotype.—*Camptostroma roddyi*, new species.

CAMPTOSTROMA RODDYI, new species

FIGURES 1, 2; PLATES 1-4

Description.—Hydrosoma free, lenticular to ellipsoidal or spheroidal in shape, of size of a small apple (largest, diameter 66.5 mm;



FIGURE 1.—Diagrammatic cross section of the holotype of *Camptostroma roddyi*, showing fold on both the upper and under sides produced by lateral compression

another, incomplete, 45 mm), flexible, probably floating. One side (upper?) possessing a central, circular to elliptic, slightly convex area (33 by 28 mm in type), with depressed center; its surface is granular and perforated by fairly evenly distributed (in quincuncial



FIGURE 2.—Vertical section of *Camptostroma roddyi*, showing the layer of coenenchym with the thecal pores on upper and under sides and monticules on underside. The dotted lines indicate extent of ribs

arrangement) subcircular depressions (many of which have a limonite nodule at the bottom and originally were undoubtedly pores), about 0.5 mm in diameter and 1.5 mm apart. Many of the pores surrounded by somewhat crudely radiate or stellate furrows, suggesting a primitive form of astrorhizae of the Tubulariae (as *Porosphaera*) and Stromatoporoidea.

² Καμπτός, flexible + στρώμα, layer.

Central smooth areas surrounded by a concentric zone of prominent radiating ribs, about 10 mm long and 1 mm wide, separated by equally wide intervals. Ribbed area possessing granular surface like the central one, but lacking the pores.

The marginal region of the upper side (outside the ribbed area) and the whole under surface composed of short (about 0.5 mm long), straight or slightly curved, vertical, platelike spicules that form a reticulate meshwork with irregular, circular, polygonal, and elongate pores, averaging 0.5 mm in diameter. Where best preserved they are fairly uniformly circular. Between them, in the middle of the underside, are fairly evenly distributed monticules, about 2 mm apart and 1.5 to 2.5 mm in diameter, circular in outline, slightly convex, surrounded by radiating spicules, and often provided with a central group of round knobs and depressions.

One of these specimens was collected more than 10 years ago by Dr. H. Justin Roddy, then at the Teachers College, Millersville, Pa., and now at Franklin and Marshall College in Lancaster, Pa., while the holotype was obtained by him in 1931.

Horizon and locality.—Lower Cambrian, Kinzers formation (*Olenellus* zone): Loc. 12x, Fruitville, 3 miles north of Lancaster, Pa.

Holotype and paratypes.—U.S.N.M. No. 85181.

CAMPTOSTROMA RESSERI, new species

PLATE 3. FIGURES 1-3

Another fossil of similar outline and character—merely an impression in black Lower Cambrian slate from North Granville Bridge, N. Y., found in the National Museum's collections—was later sent to me for comparison with *Camptostroma rodnyi*.

The specimen is labeled "medusa imprint?," and indeed at first glance it suggests a medusa more than anything else. The conclusions, however, that were obtained in regard to *Camptostroma* and the presence of a small portion of the original skeleton of the fossil found in the center support the view that this fossil is actually congeneric with *C. rodnyi*. I shall therefore describe it as *Camptostroma resseri*.

Description.—Hydrosoma disk shaped or lenticular, of circular outline, about 7.5 cm in diameter. Central area of the side exposed, somewhat elevated and surrounded by a ring of wedge-shaped lobes with flat, smooth surfaces, about 20 mm long and 5 to 7 mm wide at the outer extremity. The outer margin is slightly scalloped corresponding to the lobes. The small portion of the body of the fossil in the center consists of a porous mass strongly resembling slag, and obviously forming the interstitial filling of a meshwork of irregular spicules such as forms the skeleton in the genotype.

Remarks.—The specimen is very incomplete and therefore leaves much to be desired in the evidence for its taxonomic position. Yet the radiate surface sculpture and especially the spongy, porous body in the center clearly place this fossil in the same group with the much better known *C. rodnyi*. Likewise the body is too substantial to be derived from a soft medusa; for although found in a much compressed argillaceous slate in which organic remains are completely flattened out, as is *Dactyloidites radiatus*, the impression of this *Camptostroma* reaches 1.6 mm below the surface of the bedding plane along the scalloped margin and twice as much in the central bulge. If there was a corresponding excavation on the other side of the bedding plane, as we must assume, the body reached a thickness of over 6 mm in the shale; certainly a good proof of a solid structure in the living organism such as is indicated by the small patch of meshwork in the center.

Horizon and locality.—Lower Cambrian: North Granville, N. Y.

Holotype.—U.S.N.M. No. 85951.

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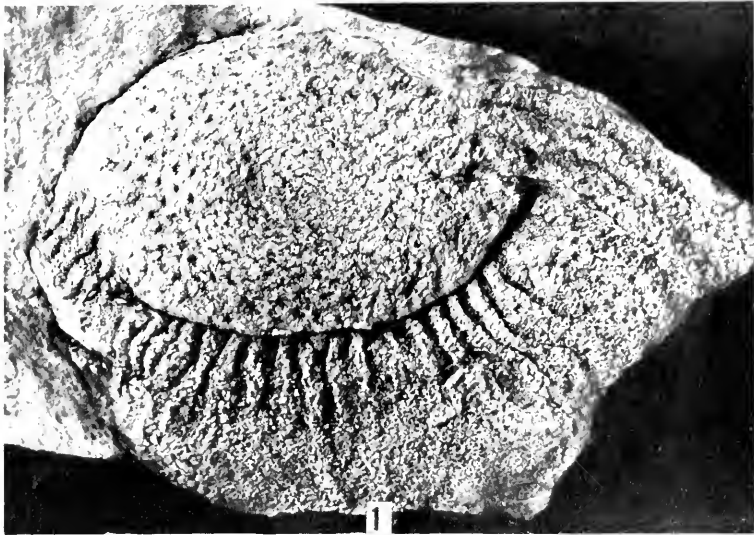
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CAMPTOSTROMA RODDYI, NEW SPECIES

- 1, Dorsal view of squeeze of holotype ($\times 1\frac{1}{2}$); 2, view of the underside of holotype ($\times 1\frac{1}{2}$); 3, portion of supposed ventral side enlarged to show monticules ($\times 8$). Lower Cambrian, Kinzers formation (*Olunellus* zone); Fruityville, 3 miles north of Lancaster, Pa.

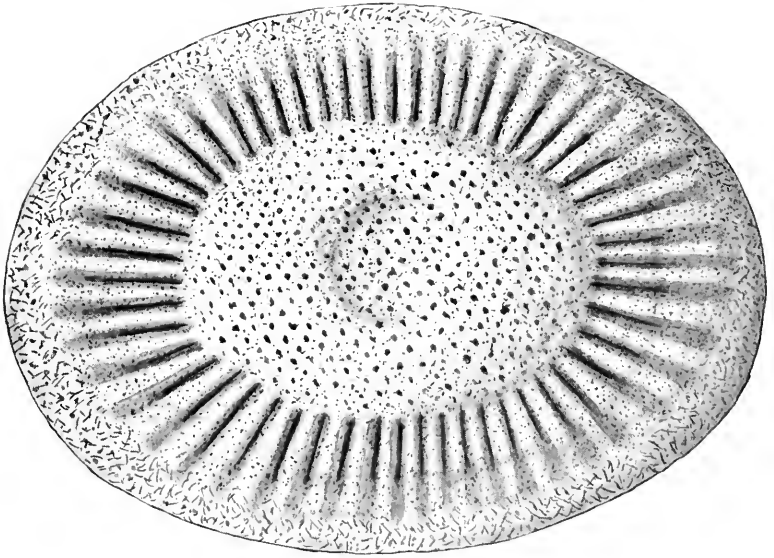


CAMPTOSTROMA RODDYI. NEW SPECIES

View of portion of supposed dorsal surface of holotype showing at the left the central disk, in the middle its outer part with large pores, and at the right the ribbed portion of the animal (X 8).
Locality same as Plate 1.

CAMPTOSTROMA RESSERI AND *C. RODDYI*. NEW SPECIES

1-3, *Camptostroma resseri*: 1, Holotype; 2, enlargement of central portion showing structure ($\times 8$); 3, gutta-percha squeeze of holotype shown in Figure 1. Lower Cambrian, North Granville, N. Y.
 4, 5, *C. roddyi*: 4, Another individual exhibiting a thin siliceous film upon which the surface was impressed and which has flaked off in several places revealing the matrix ($\times 1\frac{1}{2}$); 5, a second rather poor paratype ($\times 1\frac{1}{2}$). Locality same as Plate 1.



CAMPTOSTROMA RODDYI, NEW SPECIES

Restoration of supposed top surface (upper figure) and of side view (lower figure) of this interesting colony. Locality same as Plate I.

DESCRIPTIONS OF NEW ICHNEUMON-FLIES, WITH TAXONOMIC NOTES

By R. A. CUSHMAN

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This paper consists of the descriptions of 1 new genus, 9 new species, and 1 new variety of Ichneumonidae and notes on 10 other species, one of which is assigned a new name.

Most of the species discussed have been reared from insects of economic importance. All but two are North American, these being European species that have been reared at the Gipsy Moth Parasite Laboratory, Melrose Highlands, Mass., during a study of the parasites of the introduced birch leaf-mining sawfly, *Phyllotoma nemorata* (Fallen).

Genus HOPLISMENUS Gravenhorst

HOPLISMENUS RUTILUS (Cresson), new combination

Ichneumon rutilus CRESSON, Proc. Ent. Soc. Philadelphia, vol. 3, p. 169, 1864;
Trans. Amer. Ent. Soc., vol. 6, p. 185, 1877, female.

Genus AMBLYTELES Wesmael

AMBLYTELES PROPITIUS (Cresson), new combination

Ichneumon propitius CRESSON, Trans. Amer. Ent. Soc., vol. 4, p. 156, 1872; vol. 6, p. 182, 1877, male.

Two males and three females reared at the Gipsy Moth Parasite Laboratory in June, 1931, from pupae of *Cinclidia harrisii* Scudder, collected at Lynnfield, Mass., and Deering, N. H., together with the type male and five other females from localities ranging from Hampton, N. H., to Champaign, Ill., are before me. One of the latter was reared by Dr. A. S. Packard from *Phyciodes tharos* (Drury).

The apices of the second and third tergites in the type are not blackish as described by Cresson but a little darker reddish than the surface generally. The scutellum and first tergite are narrow, the former subdistinctly margined laterally well beyond the base and the latter barely half as broad at apex as long. The areola is distinctly separated from the basal median area, not extending to base as described by Cresson. The areolet is not triangular, as described, but pentagonal, with the second recurrent well beyond the middle.

Except that the Massachusetts males are somewhat stouter and have the scutellum somewhat broader and margined at base and the

first tergite a little more than half as broad at apex as long, these specimens are much like the type.

Because of its rather prominent propodeal angles the female might be run to *rutilus* Cresson in that author's key to the North American species of *Ichneumon*; but, as indicated above, *rutilus* is a *Hoplismenus* differing from the present species by the characters distinguishing *Hoplismenus* from *Amblyteles*. Run beyond this point in the key, this species is difficult to place, because of the marked variation in the sculpture of the postpetiole, which varies from nearly smooth to rather coarsely rugulose punctate. Specimens with nearly smooth postpetiole run best to *rubicundus* Cresson, from which they are at once distinguishable by many characters, including the longer and more slender antennae, much longer malar space, flat and nearly unseparated clypeus, and the entire lack of the scopa on hind coxa. From *soror* Cresson, to which those specimens with punctate postpetiole run, it differs by all the characters listed above except the last, as well as in many other details.

Particularly characteristic of this species is the clypeus. In profile this is flat, continuous with the face, with only a faint indication medially of a separation between the two; apically the clypeus is very broadly and straightly truncate, with the lateral angles very prominent and extending over the bases of the mandibles.

AMBLYTELES HETEROCAMPAE, new species

In Cresson's key to *Ichneumon*, females, Section IV, this species runs to (*signatipes* Cresson) = *duplicatus* (Say), from which it is at once distinguishable by its black femora, longitudinally striate postpetiole, rather deep transverse gastrocoeli, and lack of coxal scopa. In the structural characters mentioned above it is very much like *funestus* (Cresson), from which its red mesoscutum and yellow-annulated tibiae distinguish it.

Female.—Length 13 mm. Head distinctly narrower than thorax, temples convexly receding, their length (anteroposteriorly) hardly as long as short diameter of eye; diameter of an ocellus slightly less than ocell-ocular or postocellar line, which are about equal; vertex, frons, and temples opaque coriaceous, with distinct separated punctures; eyes slightly divergent below, their inner margins a weak sigmoid curve with its concave part opposite the frons; face sub-polished, sparsely and coarsely punctate, divided into three somewhat tumid areas by a longitudinal impression each side of middle; clypeus rather weakly separated from face, about twice as broad as long, broadly and straightly truncate at apex, polished, with a few coarse punctures in basal middle; mouth fully as broad as face, mandibles rather long and narrow; cheeks in front view strongly convergent, nearly straight; malar space as long as basal width of mandible; antennae about half as long as body, coiled, 37-jointed,

flagellum with short, thick joints, first joint barely a half longer than thick, joints in apical third flattened below and a little broadened. Thorax stout, slightly broader than deep, generally rather densely punctate, finely above and more coarsely so below, lower pleura more or less rugosely so; scutellum flat and virtually impunctate; propodeum without distinct costulae, areola about as long as broad and subquadrate, sometimes with the sides curved and the base and apex of equal width and sometimes straight with base broader than apex, median areas finely irregularly rugose, lateral areas coarsely transversely rugose, pleural areas irregularly rugose; legs stout, coriaceous, coxae coarsely punctate, femora almost impunctate, hind coxa without a scopa. Abdomen broad fusiform, finely coriaceous; postpetiole very broad, longitudinally striate, second tergite coarsely sparsely punctate, third and fourth less distinctly so and only at base, gastrocoeli distinct, transverse, striate, widely separated; ovipositor very slightly exerted, hypopygium retracted.

Head largely ferruginous in front, black behind, the red usually completely encircling the eyes but rarely interrupted in upper posterior orbits, frontal scrobes and a broad streak each side of middle of face black, inner orbits more or less distinctly yellowish; antennae black, scape below and flattened surface of flagellum reddish, a broad white annulus embracing most or all of flagellar joints 5-14; mandibles reddish; palpi dusky stramineous, the labial palpi sometimes piceous. Thorax black with mesoscutum except margins ferruginous and scutellum white; wings yellowish hyaline, veins black, stigma dark testaceous; legs black, apical trochanter joints and tarsi ferruginous, tibiae white annulate, front and middle tibiae otherwise ferruginous, hind tibiae ferruginous at base, black at apex. Abdomen ferruginous, petiole black, postpetiole laterally and a small spot on seventh tergite usually yellow.

Host.—*Heterocampa guttivitta* Walker.

Type locality.—North Heath, Mass.

Type.—U.S.N.M. No. 44066.

Remarks.—Described from the following four females: The type, reared July 7, 1931; one found in a rotten stump at Mahwah, N. J., March 24, 1925, by F. M. Schott; one from Put in Bay, Ohio, June 20-30, 1924; and one labeled simply "Ohio."

Only the holotype has complete antennae.

AMBLYTELES CTENUCHAE, new species

In Cresson's key to *Ichneumon*, females, Section IV, this species runs to *funestus* (Cresson), to which it is very closely related. It is easily distinguished from *funestus* by its longer and more slender antennae and legs. In *funestus* the flagellum is noticeably stouter

beyond the middle, while its first joint is only a little longer than thick and the legs are very stout, the hind femur being barely three times as long as deep. In *ctenuchae* the flagellum is not thickened beyond the middle, and its first joint is nearly twice as long as thick; the legs are only moderately stout, with the hind femur nearly or quite four times as long as deep.

Female.—Length 13 mm. In structure very similar to *heterocampae*, from the foregoing description of which it differs only as follows: Antennae more than half as long as body, 40-jointed, rather strongly tapering to apex, flagellar joints relatively longer, first joint nearly twice as long as thick, joints beyond middle not broadened and less distinctly flattened below; propodeum irregularly rugose all over, only a little more finely so medially; postpetiole finely coriaceous, the sculpture sometimes running into very fine striations but not distinctly, longitudinally striate; tergites 2-4 much less distinctly punctate.

In color also the species is very similar to *heterocampae*, but the head is reddish only on anterior orbits, clypeus, and mandibles, the last more piceous and the orbits not at all yellow; the scape below and the flattened surface of the flagellum are not distinctly reddish, and the antennal annulus is more reddish; the palpi are distinctly fuscous; the thorax, except the white scutellum, is entirely black; the tibiae are entirely ferruginous except that the hind tibia is black at apex; and the postpetiole and apical tergite are not yellow spotted.

Host.—*Ctenucha virginica* Charpentier.

Type locality.—Detroit, Me.

Type.—U.S.N.M. No. 44067.

Remarks.—Described from three females, all reared from the above host, two from type locality under Gipsy Moth Parasite Laboratory No. 10098M5, on July 13 and 21, 1926, and one with no other data than the host label.

Only the holotype has complete antennae.

Genus PROSCUS Holmgren

PROSCUS WALSHIAE (Ashmead), new combination

Phaeogenes walshiae ASHMEAD, Trans. Amer. Ent. Soc., vol. 23, p. 205, 1896, male and female. Type, U.S.N.M. No. 3306.

Phaeogenes (Centeterus) ineptifrons GAHAN, Proc. U. S. Nat. Mus., vol. 55, p. 113, 1919. Type, U.S.N.M. No. 21614. (New synonymy.)

The distinct, though shallow, gastrocoeli exclude this species from *Centeterus*, and the broad temples, deeply concave occiput, slender form, and unarmed hind coxae of the female place it in *Proscus*.

Since the introduction of the oriental fruit worm, *Grapholitha molesta* (Busck), into the United States, this species has become one of the most important of the parasites of the pupa of that insect.

The types of *ineptifrons* were reared from that host. Those of *walshiae* were reared from *Walshia amorphella* Clemens.

PROSCUS WALSHIAE AUSTRALIS, new variety

Identical structurally with the typical form, but differs constantly in having the abdomen entirely ferruginous.

Host.—*Laspeyresia caryana* Fitch.

Type locality.—Albany, Ga.

Type.—U.S.N.M. No. 44720.

Remarks.—Five females (one holotype) and two males (one allotype) reared by Herbert Spencer, Luther Brown, and H. S. Adair, of the fruit-insect division of the U. S. Bureau of Entomology.

The specimens are said to have been reared from pupae of the host that had been isolated as larvae.

Genus HEMITELES Gravenhorst

HEMITELES PINIFOLIAE, new species

Allied by its short, stout first abdominal segment to *gracilariae* Ashmead and *bucculatricis* Ashmead. From the former it is easily distinguished by its broad temples and from the latter by its much more strongly sculptured and longer abdomen and by its shorter ovipositor.

Female.—Length 3.5 mm. Slender, the thorax fully twice as long as deep, its depth and breadth about equal, the abdomen nearly four times as long as broad. Head large, broader than thorax, in side view somewhat like that of *Eoichus*, temples strongly rounded, nearly or quite reaching outside tangent of eyes; face opaque punctato-coriaceous, very strongly receding, with a median longitudinal ridge; eyes large, shallowly convex, about as long as width of face, parallel within; clypeus small, short, apically truncate for its entire width; mouth distinctly narrower than face, mandibles small; malar space about equal to basal width of mandible; antennae long, slender, slightly thickened toward apex, 19-jointed. Thorax granularly opaque, only the scutellum and speculum polished and the pronotum laterally subpolished; notauli briefly impressed; posterior face of propodeum much shorter than horizontal face, transverse carinae, especially the basal carina, weak, median carinae absent; stigma rather broad, radius just beyond middle, radial cell short, hardly as long on metacarpus as stigma; areolet rather small, pentagonal, open, cubitus lacking beyond position of second intercubitus; basal vein very strongly curved, so that it meets the median vein at a slightly acute angle; nervellus distinctly broken well below middle. Abdomen largely granularly opaque, only the apical tergites and the apices of the other tergites polished, the apices of second and third slightly tumid; first segment hardly as long as second, nearly as

broad as long, petiole broad and flattened above, spiracles a little beyond middle; tergites 6 and 7 unusually long, tergite 8 nearly concealed; ovipositor sheath barely longer than second tergite, ovipositor more than twice as long as its sheath.

Black; clypeus and mandibles piceo-testaceous; antennae brown, testaceous below toward base; legs reddish testaceous, hind coxae more or less piceous, hind tibia and tarsus darker above; wings hyaline, stigma and veins brown, tegula and radix stramineous.

Male.—Much like female, but all coxae definitely piceous to black, antennae black with scape piceous and pedicel testaceous below; tergites less broadly and less definitely polished at apex.

Type locality.—Lunenburg, Mass.

Type.—U.S.N.M. No. 44068.

Remarks.—Three females and one male reared under Gipsy Moth Parasite Laboratory No. 12458P1 from pine needles infested by *Paralechia pinifoliella* Chambers, but whether as primary or secondary parasites is not known. The specimens emerged on June 27 and 28, 1928, and June 12, 1929.

Genus TRICHOCRYPTUS Thomson

TRICHOCRYPTUS ATLANTICUS Cushman

Three specimens of the undescribed male of this species have been received from C. W. Johnson along with three females, all from Nantucket Island, Mass. It differs from the female strikingly in the color of the abdomen, which is black with tergites 1-5 more or less dark ferruginous, the first at apex, the others apically and laterally, and the second sometimes so at base. The vertex is arched distinctly above the level of the top of the eyes, the malar space is slightly shorter than basal width of mandible, the antennae are 25-jointed (20- to 21-jointed in female), the first joint of flagellum is fully as long as second, the scutellum white only at apex, the pubescence of head and thorax is darker colored and less dense than in the female, the wings distinctly brownish infumate, the first abdominal segment narrower with the dorsal carinae extending to the tip and with a more or less distinct median depression just beyond the spiracles, the hind femur black at apex, the hind tibia infusate above and the tarsus practically black.

In one of the females the scutellum is black. Another female from Massachusetts (Baker collection) differs from the type practically only in being larger with the abdomen relatively a little stouter.

Genus NEOSTRICKLANDIA Viereck

Neostricklandia VIERECK, Can. Ent., vol. 57, p. 75, fig., 1925. (Genotype, *Neostricklandia sericata* Viereck.)

Trichestema CUSHMAN, Proc. U. S. Nat. Mus., vol. 72, art. 13, p. 9, fig. 1, 1927. (Genotype, *Trichestema helcostizoides* Cushman.) (New synonymy).

In describing my *Trichestema* I overlooked Viereck's earlier genus. There can be no doubt of the synonymy.

NEOSTRICKLANDIA HELCOSTIZOIDES (Cushman), new combination

Trichestema helcostizoides CUSHMAN, Proc. U. S. Nat. Mus., vol. 72, art. 13, p. 9, fig. 1, 1927.

Very similar to *sericata* Viereck, but the type differs from the description of *sericata* as follows: Malar space almost exactly as long as basal width of mandible (not shorter as stated in original description of *Trichestema*); posterior ocelli at same level as top of eyes; stigma dark only along anterior margin, otherwise testaceous; middle femur entirely ferruginous, hind femur the same except at apex, where it is slightly infusate; middle tibia at base black, hind tibia entirely reddish fuscous, darker at base; median carinae distinct to apical carina, defining a combined areola and basal area, which broadens abruptly at the costulae; ovipositor beyond apex of abdomen less than half as long as abdomen (sheath very slightly more than half as long).

My figure is erroneous in that it shows the middle abscissa of the basal carina of propodeum and the basal abscissae of the lateral carinae. These abscissae are absent.

Since the publication of my description I have received for identification from C. W. Johnson two females and five specimens of the hitherto undescribed male, all taken by him on Nantucket Island, Mass. Both females differ from the type in having the second and third tergites distinctly ferruginous, the hind femur entirely and the tibia except at base and apex ferruginous, and the antennae 23- and 24-jointed. I have been unable to discover any more significant difference.

In the male the cheeks are less strongly rounded, the malar space is a little shorter than basal width of mandible, the antennae are longer and more slender and 23- to 25-jointed, with the first joint of flagellum distinctly longer than second, the white of the scutellum is much reduced or lacking, the propodeal spiracle shorter, the abdomen more polished, the pubescence less conspicuous and on wings less dense, the abdomen black with only faint reddish reflections on second and third tergites, the middle and hind femora definitely black at apex, the hind coxa black above at apex, the middle and hind tibiae deep fuscous or black above, more reddish below, and the legs more slender with apical joint of hind tarsus only as long as third joint.

ALOPHOSTERNUM, new genus

An anomalous genus that belongs to the tribe Ichneumonini as defined by Cushman and Rohwer, though disagreeing in several respects with the description of the tribe.

Head in front view roundly triangular, the malar space long and the cheeks straight; vertex posteriorly and occiput impressed medially, the occipital carina obliterated in the impression; third joint of labial palpi very short and difficult to distinguish; clypeus very short, broadly arcuately inflexed and emarginate at apex; notauli and prepectal carina absent; propodeum medially channeled nearly to apex, without carinae; subdiscoideus at or above middle of discoideus; radiella terminating abruptly about the length of abscissula beyond intercubitella, the other longitudinal veins in hind wing virtually obliterated beyond transverse veins, nervellus very weakly broken below middle; first tergite strongly narrowed before spiracles, virtually without basal angles; ovipositor subcylindrical at base, slightly compressed and subsagittate at apex. Otherwise like *Epiurus* Foerster, to which it will run in Ashmead's key.

Genotype.—*Alophosternum foliicola*, new species.

ALOPHOSTERNUM FOLICOLA, new species

Female.—Length 5 mm; antennae 3.5 mm; ovipositor sheath 1.5 mm. Head polished, impunctate; temples convexly receding; diameter of lateral ocellus equal to postocellar line and distinctly shorter than ocellular line, a distinct longitudinal groove between the ocelli; eyes parallel within, not at all emarginate opposite antennae; face broader than long; malar space nearly as long as basal width of mandible; antennae slender, 23-jointed. Thorax distinctly less than twice as long as deep, slightly deeper than broad, polished and virtually impunctate except on lower pleura and sternum where it is sparsely punctate; propodeum impunctate; legs slender, hind tarsus equal in length to tibia, its apical joint nearly as long as second. Abdomen elongate fusiform, rather densely punctate and basally more or less shagreened, the first tergite especially shagreened and almost impunctate except at apex; first tergite a little longer than broad, others very strongly transverse, the second slightly more and the third slightly less than half as long as broad at their junction; ovipositor sheath hardly twice as long as first tergite.

Black, with mesopleurum, metapleurum, and propodeum usually more or less piceous or ferruginous; inner orbits, broadest on frons, mandibles, underside of scape, pedicel and basal joint of flagellum, humeral angle of pronotum, tegulae, and wing bases whitish; clypeus reddish; wings hyaline, veins brown, stigma lighter and grayish; front and middle legs testaceous, coxae darker, tarsi apically and in middle tarsus apices of all joints dark, middle tibia with obscure annulation of brownish and white; hind coxa and femur reddish testaceous, trochanter stramineous, tibia largely white with apical and subbasal annuli of black, pale testaceous below; hind tarsus white, all joints tipped with black; abdomen black, tergites 2-5 more

or less distinctly pale margined apically, venter white with blackish sternites.

Male.—Differs from female as follows: Ocelli larger and hardly their diameter from the eyes, though not larger in diameter than postocellar line; face very slightly narrower than frons; antennae 19-jointed; abdomen narrower, less distinctly punctate; first tergite much longer than broad, the sides beyond spiracles nearly parallel, second and third much more than half as long as broad at their junction.

Face, frons nearly to ocelli, malar space, lower cheeks, clypeus, and mandibles pale yellow; upper and lower margins of pronotum, propleura, and subalar tubercles also yellow; pleura, sternum, and propodeum entirely black; front and middle legs pale yellow, their tibiae and tarsi more reddish with apices darker; hind coxa and trochanter pale yellowish, the coxa with a piceous spot at base above; hind tarsus black except at base; tergites 2-4 with apical margins definitely white, those beyond very narrowly so.

Hosts.—*Phyllotoma nemorata* (Fallen) and *Paraclemensia acerifoliella* Fitch.

Type locality.—Ashburnham, Mass.

Type.—U.S.N.M. No. 44069.

Remarks.—Described from six females, all reared under Gipsy Moth Laboratory No. 12464 as parasites of *Phyllotoma nemorata* larvae, five from the type locality on May 25 and June 26, 1930, and one from Gorham, N. H., June 3, 1930; five females and one male received from A. E. Brower, Mount Desert, Me., who reared the females from *Phyllotoma* in June, 1930, and May, 1931, from material collected at Topsfield, West Bethel, Nicatous Pond, and Bryant Pond, Me.; and the male from *Paraclemensia* on Little Duck Island, Me., on August 6, 1931.

According to C. F. W. Muesebeck, who submitted the Gipsy Moth Laboratory specimens, this is an external parasite and is evidently a native species that has adopted the introduced sawfly as a host.

Genus GLYPTA Gravenhorst

GLYPTA CAULICOLA, new name

Glypta rufiscutellaris WALSH, Trans. St. Louis Acad. Sci., p. 126, 1873 (not Cresson, 1870).

Glypta animosa (CRESSON) RILEY and HOWARD, Ins. Life, vol. 3, p. 463, 1891.

Walsh's description is of a different species from the one described under this name by Cresson. Walsh may have had the two species confused in his material and may even have sent to Cresson specimens conspecific with Cresson's type. In Cresson's species, judged from large series reared from *Grapholitha molesta* (Busck), the mesosternum is always black and the red color confined at most to a band on the pleurum extending forward somewhat obliquely from

the middle coxae. On the other hand, Walsh's species is described as having the mesosternum and more or less of the mesopleurum red. The description is based primarily on the female. The first female mentioned, therefore, would be the logical choice for lectotype were the specimens in existence. Unfortunately they were destroyed in the Chicago fire in 1871. The first female mentioned is the one reared from the gall of (*Euryptychia saligneana* Clemens) = *Epilema scudderiana* Clemens on goldenrod. In the National Museum is a female, reared March 16, 1887, from this host, which agrees almost perfectly with Walsh's description. It is recorded as *Glypta animosa* Cresson in *Insect Life* as cited above. This specimen I hereby designate the neotype of *Glypta rufiscutellaris* Walsh (not Cresson) and rename the species as above.

Otherwise the neotype differs from *rufiscutellaris* Cresson by having the cheeks more strongly rounded, the flagellum stouter with second joint distinctly less than twice as long as thick, the ovipositor a little shorter, hardly as long as abdomen, and the upper lateral margin of pronotum white throughout.

Other specimens that I place under this species were reared by Frank D. DeGant at Cleveland, Ohio, from the gall of *Gnori-moschema gallaesolidaginis* Riley and, apparently by Riley at St. Louis, from "stem of wild hemp."

The extent of red on the thorax in both *rufiscutellaris* Cresson and *caulicola* varies greatly, specimens occurring in both species in which the mesoscutum, mesopleura, mesosternum, metapleurum, metasternum, and sometimes even the scutellum are entirely black. In *caulicola* the red first appears on the mesosternum and metasternum and on the lateral lobes of the mesoscutum, while in *rufiscutellaris* it appears first just in front of the coxae on the pleura and in the notauli on the mesoscutum.

Genus LATHROLESTES (Foerster) Davis

LATHROLESTES METALLI, new species

Female.—Length 6.5 mm; antennae 6.5 mm. Head strongly transverse, subopaque granulate; temples not reaching nearly to outside tangent of eyes, strongly convex; occipital carina broadly interrupted medially; diameter of an ocellus a little shorter than postocellar line and little more than half ocell-ocular line; eyes slightly convergent below; clypeus broad, in profile with apex prominent, with a fringe of long hairs, foveae large; malar space much less than half basal width of mandible, the latter with lower tooth much larger and longer than upper; antennae very slender, filiform, 37-jointed. Thorax dorsally granularly opaque, laterally and ventrally subpolished; notauli distinct anteriorly, scutellum compressed, subpolished; propodeum with only the petiolar area defined, all other carinae wanting, spiracles well above plural carina; areolet rather

large, oblique; discocubitus very strongly curved; nervulus slightly postfurcal; nervellus broken below middle; legs slender; longer hind calcarium distinctly less than half as long as basitarsus. Abdomen subopaque granular; first segment a little more than twice as long as broad at apex, medially longitudinally impressed, spiracles distinctly before middle; ovipositor sheath slender, about as long as second tergite but not extending beyond apex of abdomen.

Black; frontal orbits, broadening opposite ocelli, yellow; temples pale reddish, black of occiput reaching eyes above; malar space and clypeus yellowish; mandibles and other mouth parts whitish; face brown; scape, pedicel, and basal joints of flagellum yellowish, flagellum brown, paler below. Anterior lateral margin of pronotum narrowly pale reddish, its humeral angle white; meso-metapleural suture reddish; scutellum piceous apically; wings hyaline, stigma and veins brown, costa stramineous, radix and tegulae white; legs ferruginous, front and middle coxae and trochanters and hind trochanters stramineous, hind tarsi paler than tibiae. Abdomen ferruginous, first segment entirely black, second tergite and apex more or less stained with blackish, plica yellow.

Male.—Head largely yellow, the black being confined to stemmaticum, upper median part of frons, vertex medially and along occipital carina, and upper part of occiput; upper posterior orbits pale testaceous. Entire prothorax, broad lateral margins of meso-scutum, mesopleurum except above, mesosternum, and all coxae and trochanters pale yellow; scutellum and postscutellum ferruginous; spot on metapleurum yellowish testaceous. First tergite at apex and apical tergite ferruginous. Genital sheath slender, nearly as long as second tergite, pale testaceous. Otherwise much like female.

Host.—*Metalus rubi* Forbes.

Type locality.—Beamsville, Ontario, Canada.

Type.—U.S.N.M. No. 44070.

Paratypes.—Canadian National Collection, Ottawa, Ontario.

Remarks.—Two of each sex, the females from the type locality and the males from Vineland, Ontario, reared by W. L. Putnam, May 30 to June 7, 1929.

Both female and male paratypes are smaller and have the abdomen more extensively black, the second tergite especially being almost entirely black.

LATHROLESTES PICTUS, new species

Female.—Length, 3 mm; antennae 3 mm. Head for the most part minutely shagreened, from above transverse, temples strongly convex, not reaching outside tangent of eye; occipital carina broadly interrupted medially; postocellar and ocellocular lines equal and much longer than diameter of an ocellus; a small, but deep, longitudinal pit between ocelli; eyes subparallel within; clypeus deeply separated from face, broad with apex broadly truncate and fringed

with long setae, in profile with apex prominent; malar space distinctly less than half as long as basal width of mandible; lower tooth of mandible much larger and longer than upper tooth; antennae 26-jointed, filiform. Thorax finely shagreened, scutellum and speculum polished; propodeum with petiolar area rugulose and incompletely defined medially, apical lateral areas also rugulose and obscurely defined, other carinae absent; areolet small, nearly triangular, nervulus interstitial, nervellus weakly broken below middle; hind tibia and tarsus nearly equal in length, calcaria less than half as long as basitarsus. Abdomen finely shagreened, short and broad; first tergite little longer than broad at apex, its sides straight and strongly convergent basally, petiole strongly depressed, without dorsal carinae, spiracles slightly before middle; second tergite only a little more than half as long as broad at base, others relatively even shorter; ovipositor sheath nearly as long as first tergite.

Black; face, complete orbits, clypeus, and mandibles yellow; scape and pedicel largely yellow, flagellum brown above, ferruginous below, yellowish toward base. Upper and lower margins of pronotum, propleura, lines in positions of notauli, broad lateral margins of mesoscutum, subalar tubercles, and margin of prepectus yellow; a longitudinal mark on lower mesopleurum brownish (this is sometimes yellow and confluent with the prepectal margin); wings hyaline, veins and stigma brown, base and apex of stigma, costa, and tegulae yellowish; legs yellowish testaceous, tibiae and tarsi stramineous, hind coxae black at extreme base above. Narrow lateral margins of tergites beyond second (and sometimes very narrow apical margins) pale, plica yellow, hypopygium brownish ferruginous with narrow yellow margin.

Male.—Abdomen much more slender, the first tergite nearly twice as long as broad at apex, second three-fourths as long as broad at base; apical tergite entirely concealed by seventh; genital sheath very narrow, as long as second tergite.

Yellow much more extensive than in female; pronotum almost entirely and lower pleura yellow; scutellum brownish; tergite 3 usually more or less yellow at base; tergite 8 entirely yellow; genital sheath brownish testaceous.

Type locality.—Brookings, S. Dak.

Type.—U.S.N.M. No. 44071.

Remarks.—Described from six females and ten males, all from the type locality. A paratype of each sex is returned to the South Dakota State Agricultural College at Brookings, S. Dak.

LATHROLESTES MNEMONICAE (Rohwer), new combination

Sympherta mnemonicae ROHWER, Proc. Ent. Soc. Washington, vol. 16, p. 141, 1914.

The complete triangular areola and the strongly defined apical lateral area and lateral carinae constitute the only important differ-

ences between this species and the typical *Lathrolestes*. Otherwise its similarity of form and structure, especially that of the head, leaves no doubt of its very close relationship, and I do not believe the propodeal difference is sufficient to be considered of generic value.

LATHROLESTES RUFIGASTER, new species

As in *mnemonicae* (Rohwer) the propodeum is almost completely areolated, though otherwise this species is structurally nearly typical of the genus.

Female.—Length 4.5 mm; antennae 4.5 mm. Head very finely shagreened, transverse; temples strongly convex but not reaching outside tangent of eyes, polished; occipital carina very broadly interrupted medially; ocell-ocular line much longer than postocellar line and more than twice as long as diameter of an ocellus; clypeus broadly truncate and medially impressed at apex and fringed with long hairs; malar space very short; mandibles long, with lower tooth much larger and longer than upper tooth; antennae filiform, very densely pilose, 33-jointed. Thorax minutely shagreened and sub-polished, less distinctly sculptured laterally, the pronotum laterally polished; notauli weakly impressed anteriorly; propodeum with all carinae except basal distinct, areola longer than broad, rounded anteriorly, the sides parallel posteriorly; areolet oblique rectangular. Abdomen faintly shagreened, subpolished; first tergite nearly twice as long as broad at apex, dorsal carinae distinct basally, spiracles before middle; ovipositor short, the sheath protruding only slightly beyond hypopygium.

Black, with abdomen except petiole and legs except tarsi ferruginous; mandibles and palpi pale ferruginous; antennae fuscous, more reddish below, especially at base; wings hyaline, venation brown, tegulae and radices whitish; tarsi fuscous.

Male.—Essentially like female.

Host.—*Metallus bethunei* MacGillivray.

Type locality.—Grimsby, Ontario, Canada.

Type.—U.S.N.M. No. 44073.

Remarks.—One of each sex reared September, 1920, by L. Caesar.

Genus MESOLEIUS Holmgren

MESOLEIUS PHYLLOTOMAE, new species

In Schmiedeknecht's "Opuscula Ichneumonologica" key to the European species of *Mesoleius*, this species runs best to *melanoleucus* Gravenhorst. From that species, however, it is at once distinguishable by its smaller size, slender abdomen, and polished, almost unsculptured, integument. In the generic key it might almost, because of the slender abdomen, be run to the genus *Saotis*, but the abdomen is not compressed.

Female.—Length 6 mm. Head polished, but faintly alutaceous, face and frons subopaquely so; temples reaching outside line of eyes,

their length (front to back) nearly as great as that of eye; diameter of lateral ocellus nearly as long as postocellar line but only a little more than half as long as ocellocular line; malar space about half as long as basal width of mandible; cheeks in front view straight and long; clypeus medially swollen, apically broadly emarginate; mandibles broad, upper tooth larger but not longer than lower tooth; antennae nearly as long as body, 30-jointed, slender, first joint of flagellum fully four times as long as thick at apex. Thorax rather slender, hardly two-thirds as deep as long, polished, minutely sparsely punctate on mesoscutum and lower mesopleurum, mesosternum more distinctly and more densely so; epomia apparently entirely absent; notauli very weakly indicated anteriorly; scutellum very strongly convex, not at all margined laterally; propodeum weakly roughened, subopaque, areola flattened but only weakly outlined, apical carina distinct laterally but obsolete medially; legs slender, hind tibia and tarsus of equal length, inner calcarium half as long as basitarsus; radial cell barely as long on metatarsus as stigma; areolet incomplete; nervulus postfurcal; postnervulus broken in middle; nervellus broken at lower third, inclivous. Abdomen about a third longer than head and thorax, nearly parallel-sided for most of its length; first segment distinctly longer than broad at apex, its sides diverging very gradually, medially impressed, the impression flanked by weak carinae; tergites 2 and 3 each about as long as broad at their junction, tergite 4 distinctly shorter; tergites 1 and 2 and base of 3 weakly alutaceous, abdomen otherwise polished; sheath short and nearly oval.

Black; clypeus, humeral angles of pronotum, and scutellum ferruginous. mandibles and tegulae whitish; wings hyaline, venation brown, stigma paler; legs ferruginous, trochanters, tarsi, and hind tibia whitish, apical joints of all tarsi, apices of all joints of hind tarsus, and apex of hind tibia blackish.

Male.—Essentially like female but malar space shorter, medial swelling and apical angles of clypeus less prominent, abdomen a little shorter, face and clypeus white, front coxae whitish, hind tibia with an obscure subbasal dark annulus.

Host.—*Phyllotoma nemorata* Fallen.

Type locality.—Austria.

Type.—U.S.N.M. No. 44072.

Remarks.—Described from one female and four males reared in August, 1931, under Gipsy Moth Parasite Laboratory No. 13626, from cocoons of the host collected in Austria.

Genus ADELOGNATHUS Holmgren

ADELOGNATHUS DEGANTI, new species

In Schmiedeknecht's key to European species, this species runs to *dorsalis* (Gravenhorst), with which it is obviously closely related.

From that species, however, it differs in its darker clypeus and face, apparently more distinctly areolated and less strongly sculptured propodeum, and entirely impunctate second tergite.

Female.—Length 3.5 mm; antennae 3 mm. Head largely polished, sparsely hairy, in dorsal view about twice as broad as thick with temples strongly convex; ocell-ocular line a little longer than post-ocellar line, intercellular line and diameter of ocellus equal and distinctly shorter than postocellar line; face slightly narrower than frons, nearly twice as broad as long, finely granularly opaque, medially elevated; clypeus somewhat less distinctly sculptured than face, more than half as long as broad, apically truncate for nearly the entire breadth; malar space half basal width of mandible; antennae 14-jointed, flagellum rather abruptly thickened at sixth joint; basal joint long and slender. Thorax almost entirely polished and impunctate, only the lower anterior margin of pronotum and upper anterior portion of mesopleurum obscurely punctate; pronotal scrobe weakly foveolate; notauli impressed anteriorly; propodeum with a very large, well-defined petiolar area and weakly outlined apical lateral and combined areola and basal areas, petiolar area transversely rugulose, lateral areas obscurely punctate; alar areolet open; abdomen petiolate, first tergite granularly roughened, with nearly parallel median carinae and a median groove, postpetiole about twice as broad as petiole, spiracles at about apical third; other tergites polished, unsculptured, second twice as broad at apex as at base, with minute gastrocoeli distant from base; ovipositor not exerted.

Black; clypeus brownish, mandibles yellow, palpi white; antennae fuscous with scape and pedicel yellow in front and thickened part of flagellum reddish; legs testaceous, front ones paler, all trochanters whitish, hind tibia and tarsus fuscous; wings hyaline, venation dark; abdomen black with a median yellow herring-bone mark from near base of second tergite to apex and broadening out at the apices of the tergites.

Type locality.—Puritas Spring, Ohio.

Type.—U.S.N.M. No. 44074.

Remarks.—One specimen taken June 8, 1930, by Frank D. DeGant, for whom the species is named.

Genus BENJAMINIA Viereck

Benjaminia VIERECK, Proc. U. S. Nat. Mus., vol. 42, p. 633, 1912. (Genotype, *Charops fuscipennis* Provancher.)

Zachrestoides VIERECK, Can. Ent., vol. 57, p. 177, 1925; vol. 58, p. 2, 1926. (Genotype, *Zachrestoides euphydryadis* Viereck.) (New synonymy.)

The two characters by which Viereck distinguished *Zachrestoides* from *Benjaminia*, the length of the postocellar line and the comparison of the distance between the first tergal spiracles and their distance from the apex of the tergite, are far too trivial for distinguishing genera; the latter is variable even within a species.

Both *fuscipennis* and *euphydryadis* are parasitic on species of the lepidopterous genus *Euphydryas*.

The second species of *Zachrestoides*, *intermedia* Viereck, is unknown to me, but from its possession of the complete areolet I doubt if it is really congeneric with the other two species.

BENJAMINIA FUSCIPENNIS (Provancher)

Type.—U.S.N.M. No. 1967.

Several specimens besides the type are in the National Museum. All but one from Reno, Nev., are from California, and all but the Nevada specimen were reared from the type host, *Euphydryas chalcidon* Doubleday and Hewitson.

The wings in the male are nearly hyaline.

The bright ferruginous legs, and, in the female, the dark wings distinguish the species from *euphydryadis*.

BENJAMINIA EUPHYDRYADIS (Viereck), new combination

Zachrestoides euphydryadis VIERECK, Can. Ent., vol. 58, p. 3, 1926.

One female and three males, reared at the Gipsy Moth Parasite Laboratory, Melrose Highlands, Mass., under Nos. 12410H2, N2 and 51 and 12411E2, from various localities in eastern Massachusetts, are before me. The host in each case was *Euphydryas phaëton* (Drury), the same as Viereck's type.

These specimens differ consistently from the original description in their darker palpi and legs and reddish abdominal venter, probably being more fully matured than the type.

The species is at once distinguishable from *fuscipennis* by its hyaline wings and darker legs.

Genus TRANOSEMA (Foerster) Thomson

TRANOSEMA PEDELLA (Holmgren)

A series of what appears to be this species has been received from the Gipsy Moth Parasite Laboratory. They were reared as parasites of the birch leaf-mining sawfly, *Phyllotoma nemorata* (Fallen), from material imported from Austria in connection with the introduction of parasites of that species into a severe infestation in northern New England.

None of the specimens is typical *pedella*, but several agree very closely with Holmgren's var. 1 in having the front and middle coxae entirely pale and only the hind pair black. Some specimens, however, have the hind coxae virtually entirely ferruginous. Between these two extremes stand other specimens with the coxae partly blackish. The hind tibia varies from pale ferruginous with only the apex blackish above to ferruginous only below with the upper surface yellowish in the middle and blackish at both base and apex. The stigma varies from dark to light fuscous.

Liberated at North Conway, N. H., in 1931.

DESCRIPTION OF TWO PARASITIC NEMATODES FROM THE TEXAS PECCARY

By BENJAMIN SCHWARTZ and JOSEPH E. ALICATA

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Agriculture*

In November, 1931, Dr. J. H. Cooper, a veterinary inspector of the Bureau of Animal Industry, engaged in tick-eradication work in Texas, forwarded to the bureau in Washington the viscera of three white-collared peccaries, which had been killed in the vicinity of Raymondville, Tex. This material was secured at the request of the senior author, who has been interested in the parasitic fauna of peccaries, especially in its relation to that of domestic swine. The examination of the viscera disclosed the presence in the stomach of one of these host animals of several specimens of *Physocephalus sceralatus*, a spirurid nematode of common occurrence in swine in this country, and one specimen of another spirurid of the genus *Parabronema*, described in this paper; another specimen of *Parabronema* was found in the lumen of the esophagus of the same animal. The small intestine of this host animal also contained a cestode, identified by the junior author as *Moniezia benedeni*, and reported by him elsewhere.¹ The stomachs of the remaining two animals were free from parasites. In the small intestines of these two peccaries there were found a number of trichostrongyles, which are considered as representing a new genus and new species. No other parasites were found in any of the other visceral organs examined, including the lungs, liver, and kidneys.

PAROSTERTAGIA, new genus

Generic diagnosis.—Trichostrongylinae: Head less than 25μ in diameter, with three distinct lips surrounding the mouth, and with six circumoral papillae, four of which are submedian and two lateral (amphids) in position (fig. 1, *a*). Cervical papillae were not seen. Cuticle of head not inflated. The ventro-ventral and latero-ventral rays of the bursa are widely separated, the tips of the former being in relation with a conspicuous prominence of the margin of the bursa.

¹ Journ. Parasit., vol. 9, no. 9, Sept. 1932.

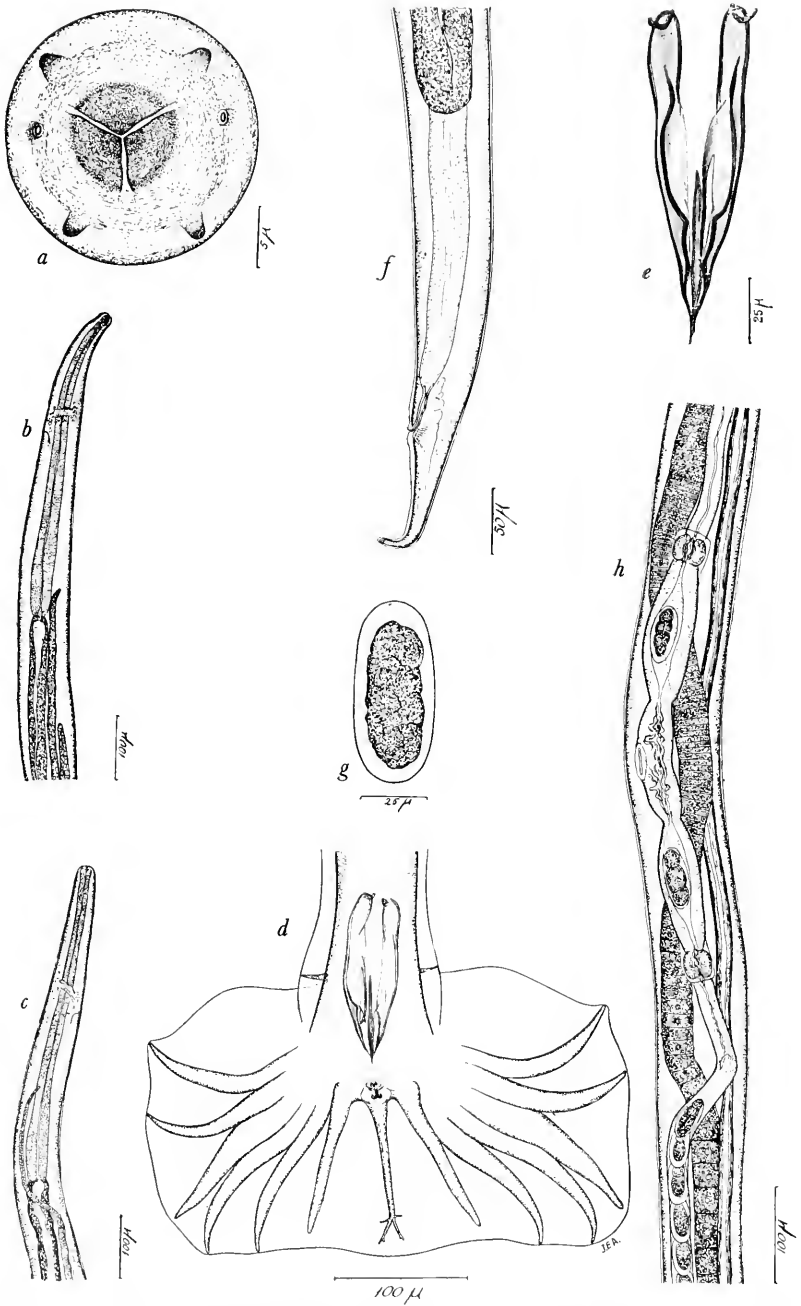


FIGURE 1.—*Parostertagia heterospiculum*, new species: a, Top view of head; b, anterior portion of body (male); c, anterior portion of body (female); d, spread-out bursa of male; e, ventral view of spicules; f, posterior portion of female; g, uterine egg; h, female in region of vulva

The tips of the externo-lateral, medio-lateral, and postero-lateral rays are in relation with the posterior border of the bursa. The externo-dorsals are given off from the dorsal ray; the latter divides distally into two branches, each of which is forked terminally; the dorsal ray gives off a slender horizontal branch on each side at about the level where it forks. An accessory bursal membrane, supported by two slender diverging rays, is present. Spicules with inner processes, the terminal portion of each spicule being acutely pointed. Gubernaculum is long and slender; prebursal papillae present. Vulva naked, located about one-fifth of the length of the body from the posterior end. Ovejectors well developed. Eggs oval, thin-shelled.

While *Parostertagia* is closely related to *Ostertagia*, it differs from the latter in two respects: (1) The relation of the ventro-ventral and latero-ventral rays to each other and (2) the character of the

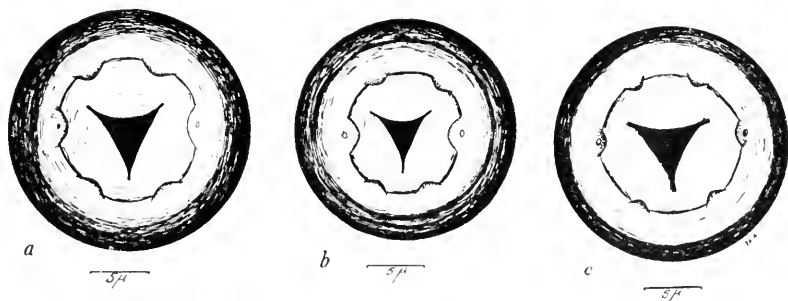


FIGURE 2. Top views of heads of *Ostertagia*: a, *O. ostertagi*; b, *O. marshalli*; c, *O. circumcincta*.

terminal portion of the main body of each spicule. In *Ostertagia* the ventro-ventral and latero-ventral rays are close together and parallel, their tips being in relation with a more or less conspicuous indentation of the margin of the bursa. In the genus *Parostertagia* the ventro-ventral and latero-ventral rays are widely separated, the tip of the former ray being in relation with a rather conspicuous protuberance of the margin of the bursa. In this genus, also, the tips of the main body of the spicules are pointed and are not embedded in rounded cuticular cushions, whereas in *Ostertagia* the corresponding portions of the spicules are truncated and are embedded in a terminal blunt cuticular cushion. Also, *Parostertagia* has three well-defined lips, which appear but feebly developed in three species of *Ostertagia* examined by the writers, as noted elsewhere in this paper.

PAROSTERTAGIA HETEROSPICULUM, new species

Specific diagnosis.—*Parostertagia*: Characters of genus. The head is provided with four relatively large submedian papillae and two smaller lateral papillae, or amphids. The mouth is surrounded by

three distinct lips. In species of the genus *Ostertagia*, examined by the writers, the lips are indistinct, as shown in Figure 2, which represents *en face* views of the heads of *Ostertagia ostertagi*, *O. marshalli*, and *O. circumcincta*.

Male, 4.4 mm to 5.5 mm long by 80μ to 85μ in maximum width. The head is about 16μ in diameter. The esophagus is club-shaped, about 452μ to 490μ long. The nerve ring divides the esophagus into two parts, that anterior to it being approximately one-half as long as that posterior to it. The excretory pore is about 205μ to 235μ from the anterior extremity of the body (fig. 1, *b*). The bursa is about 365μ wide when spread out. The ventro-ventral and latero-ventral rays are of approximately equal diameter and widely separated; both rays reach the margin of the bursa, the former being in relation with a conspicuous prominence of the margin of the bursa. The tip of the externo-lateral ray does not extend to the margin of the bursa; the tips of the medio-lateral and postero-lateral rays are in contact with the margin of the bursa. The externo-dorsals arise from the dorsal. The latter divides distally and gives off a slender lateral branch on each side, immediately in front of the two terminal branches; the latter are forked at their posterior extremities. The accessory bursa is supported by two slender rays (fig. 1, *d*). The spicules are slightly dissimilar in length and are also morphologically distinct; the right spicule is 112μ to 121μ long and is provided with a single very slender inner process; the left spicule is 117μ to 125μ long and contains two inner processes, a large one originating at a point anterior to the middle of the spicule and a very small slender one corresponding to that of the right spicule (fig. 1, *e*). The gubernaculum is 62μ to 72μ long by 7μ in maximum width (fig. 1, *e*).

Female, 4.6 mm to 5.8 mm long by 83μ to 109μ in maximum width. The head is about 20μ in diameter. The esophagus is 468μ to 510μ long. The excretory pore is 195μ to 240μ and the nerve ring 144μ to 180μ from the cephalic extremity (fig. 1, *c*). The vulva is approximately 1 mm to 1.2 mm from the posterior extremity of the body. The entire ovejector apparatus, including the sphincters, is somewhat less than 500μ long (fig. 1, *h*). The anus is located at a distance of 90μ to 115μ from the posterior extremity. The terminal portion of the tail is bent ventral, the tip being bluntly rounded (fig. 1, *f*). The eggs are 60μ to 72μ long by 24μ to 26μ wide (fig. 1, *g*).

Host.—*Pecari angulatus angulatus* (Cope).

Location.—Small intestine.

Locality.—Vicinity of Raymondville, Tex.

Type specimens (male and female).—U.S.N.M. Helm. Coll. No. 30165.

Paratypes.—U.S.N.M. Helm. Coll. No. 30166.

In Table 1 are given data showing certain size relationships in both sexes of *Parostertagia heterospiculum*.

TABLE 1.—Size relationships of male and female specimens of *Parostertagia heterospiculum*

MEASUREMENT	MALES					FEMALES				
	1	2	3	4	5	1	2	3	4	5
	μ	μ	μ	μ	μ	μ	μ	μ	μ	μ
Length.....	4,400	4,500	4,700	4,500	5,500	5,800	4,600	5,400	5,000	5,500
Maximum width.....	85	80	85	85	85	100	85	98	83	91
Length of esophagus.....	483	490	452	452	483	483	468	510	468	510
Nerve ring from anterior extremity.....	160	169	167	167	167	180	159	152	144	152
Excretory pore from anterior extremity.....	205	235	228	228	205	240	195	195	195	220
Length of spicules:										
Right.....	114	112	116	121	114					
Left.....	125	121	121	125	117					
Length of gubernaculum.....	68	62	68	72	68					
Vulva from posterior end.....						1,119	1,015	1,222	1,036	1,155
Length of ovejector apparatus.....						436	436	483	421	421
Length of tail.....						90	95	115	110	110

Genus PARABRONEMA Baylis, 1921

PARABRONEMA species

The two female specimens of *Parabronema* (U.S.N.M. Helm. Coll. No. 30164), collected from the esophagus and stomach of a peccary, showed the size relationships presented in Table 2.

TABLE 2.—Size relationships of two female specimens of *Parabronema sp.*

MEASUREMENT	SPECIMEN 1	SPECIMEN 2
	μ	μ
Length.....	19,000	20,000
Maximum width.....	171	156
Length of cordons.....	19	19
Distance between anterior extremity and posterior margin of cordons.....	53	53
Length of anterior portion of esophagus.....	159	114
Length of posterior portion of esophagus.....	1,700	1,555
Distance between anterior extremity and —		
Excretory pore.....	281	243
Cervical papillae ¹	251	
Vulva.....	245	
Vulva.....	4,137	3,853
Length of tail.....	152	136

¹ The cervical papillae are asymmetrical in position.

The morphological details of this species of *Parabronema* are shown in Figures 3 and 4, which illustrate the anterior portion of the body, the region of the vulva, and posterior portion of the body. None of

the morphological features shown by these two female specimens appears to the writers to possess specific value.

In the absence of male specimens it is impossible to determine with certainty whether the female specimens of *Parabronema* referred to above represent a new species. However, considering the host from which these specimens were collected and the locality in which this host occurs, we can safely predict that when corresponding male spec-

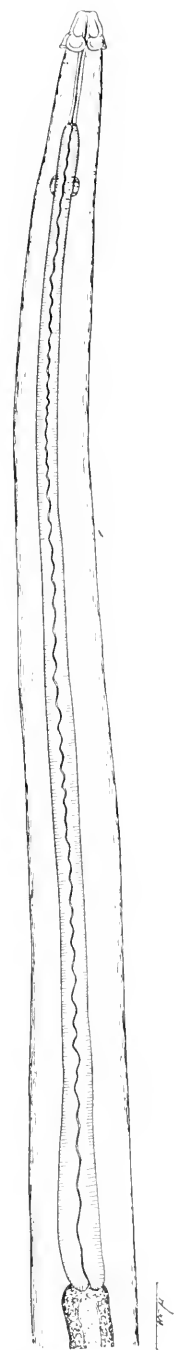


FIGURE 3.—*Parabronema* sp.: Anterior portion of female

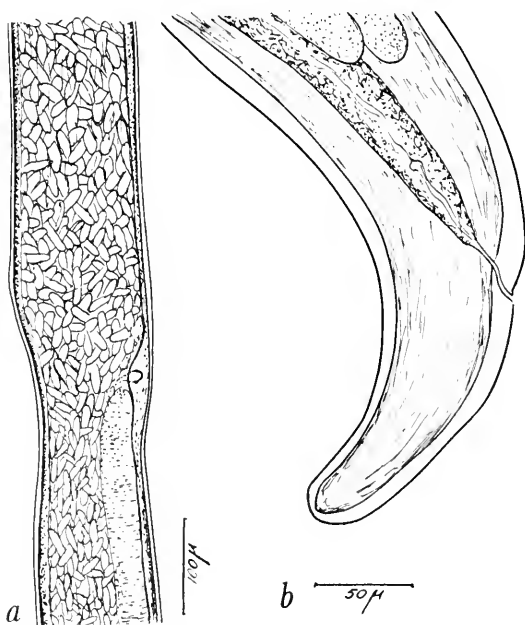


FIGURE 4.—*Parabronema* sp. a, Region of vulva; b, posterior portion of female

imens are discovered they will be found to represent a species distinct from any which have been described up to the present time as belonging to the genus *Parabronema*. *P. indicum* Baylis, 1921, and *P. smithi* (Cobbold, 1882) are from the Indian elephant, while *P. africanum* Baylis, 1921, and *P. rhinocerotis* Khalil, 1927, described on the basis of a female specimen, are from the rhinoceros. *P. skrjabini* Rasowskaia, 1924, is described from horned cattle and sheep in Turkestan. The present record is, therefore, the first one concerning the occurrence of this genus in North America.

NEW TERMITES FROM INDIA

By THOMAS E. SNYDER

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Recently, Cedric Dover, of the Forest Research Institute, Dehra Dun, United Provinces, India, gave me the opportunity of examining a small collection of termites from India. The present paper is based on this material together with a few other termites which had previously been sent to me by other officials at Dehra Dun. In it hitherto unknown castes, as well as new species, are described.

The Indomalayan termite fauna shows the greatest affinity with that of the Ethiopian region; the next closest affinity is with the neotropical region. Next to the Ethiopian, the Indomalayan region has the greatest number of genera and subgenera, but next to the Ethiopian, the neotropical region has the greatest number of species.

Table 1 presents a comparison of the known termite fauna of India and of Ceylon and shows that the family Kalotermitidae is but poorly represented in India. This difference is regarded as more apparent than real, and more collecting of these less conspicuous termites will undoubtedly reveal new species. The termites that build mounds and carton-tree or ground nests always receive first attention.

TABLE 1.—*Comparison of known termite fauna of India and of Ceylon*

Classification	Termites of India	Termites of Ceylon
Families.....	4	3
Genera.....	16	14
Subgenera.....	18	16
Species:		
Hodotermitidae.....	2	0
Kalotermitidae.....	5	14
Rhinotermitidae.....	7	15
Termitidae.....	59	40
Total.....	73	59

¹ Includes species not yet described.

² 11 occur also in Ceylon.

Eleven new termites are described in this paper: Three in the family Kalotermitidae, one in the family Rhinotermitidae, and seven in the family Termitidae, making a total of 84 species for India.

Drawings for the figures in this paper were made by H. B. Bradford, of the United States Bureau of Entomology.

Family KALOTERMITIDAE

KALOTERMES (NEOTERMES) ANDAMANENSIS, new species

Description.—Dealated adult: Head castaneous-brown, with fairly dense long bristles; V-shaped marking on epicranial suture. Eyes black, large, close to lateral margin of head. Ocellus white, large, obliquely touching eye. Antennae (broken ?) with 11 segments, third segment shorter than second but longer than fourth. Pronotum slightly lighter colored than head, with long bristles, anterior margin shallowly concave, posterior margin slightly emarginate. Pulvillus between claws. Abdomen with tergites yellow-brown and with row of bristles.

Measurements.—Length of dealated adult, 7.5 mm; length of head (to tip of labrum), 1.9 mm; length of pronotum, 1 mm; length of hind tibia, 1.3 mm; long diameter of eye, 0.5 mm; width of head, 1.65 mm; width of pronotum, 1.7 mm.

Type locality.—North Andaman Island.

Holotype.—Dealated female adult, tube 19, British Museum; morphotype, apterous male, Forest Research Institute, Dehra Dun, United Provinces, India.

Remarks.—Close to *Kaloterмес (N.) greeni* Desneux of Ceylon, but smaller and pronotum less emarginate.

Described from a single dealated female adult collected with nymphs and an apterous male at the type locality "ex unknown wood," by C. E. C. Beeson, 4 to 12, III, 30.

Apterous male reproductive adult of a yellow-brown; eye spots white and smaller than in the macropterous adult and the ocelli farther from the eyes.

KALOTERMES (NEOTERMES) BOSEI, new species

Description.—Soldier: Head light castaneous-brown, with scattered very long bristles and short hairs. Eye spot white, oval, large, its long diameter the same length as first segment of antenna. Gula very narrow at middle, about one-third as wide as width at front. Antennae with 10 segments, third segment slightly modified and darker, longer than second or fourth. Mandibles black, fairly narrow and straight, slightly incurved at apex. Left mandible with two pointed marginal teeth at apical third and two molars in basal third;

right mandible with large pointed tooth in middle and a molar near base, inner margin of apical third of mandible roughened. Pronotum with slight tinge of yellow, with long bristles, margins shallowly concave anteriorly but nearly straight posteriorly. Mesonotum and metanotum with short wing pads. Hind tibiae slightly swollen. Abdomen with a row of long bristles at base of each tergite.

Measurements.—Length of entire soldier, 11.5 mm; length of head with mandibles, 5.3 mm; length of head without mandibles, 3.2 mm; length of left mandible, 2.1 mm; length of pronotum, 1.2 mm; length of hind tibia, 1.6 mm; width of head, 2.4 mm; width of pronotum, 2.4 mm.

The eye spot is larger than in *Kalotermes (Neotermes) fletcheri* Holmgren or *assmuthi* Holmgren, compared with cotype material.

Nymph of winged adults.—Head nearly round, with large eye and small ocellus, latter separated from eye by a distance greater than its diameter, head with long bristles. Antennae with 15 segments, third longer than second or fourth. Pronotum lighter colored than head, with long bristles, shallowly concave at anterior margin, posteriorly nearly straight.

Ocellus smaller and farther from eye than in *fletcheri* and in *Kalotermes (Neotermes) greeni* Desneux.

Measurements.—Length of head, 2.1 mm; length of pronotum, 1 mm; length of hind tibia, 1.35 mm; long diameter of eye, 0.4 mm; width of head, 1.9 mm; width of pronotum, 2.4 mm.

Type locality.—Mathranwala, Dehra Dun, United Provinces, India.

Holotype.—Soldier, tube 14, in British Museum.

Comorphotypes.—Nymphs and winged adult in Forest Research Institute, Dehra Dun, United Provinces, India, and United States National Museum.

Remarks.—Described from one soldier collected with nymphs at the type locality by "M. Bose, 16, XI, 30, ex *Ficus* sp. (rotten)." Named in honor of the collector.

KALOTERMES (NEOTERMES) GARDNERI, new species

FIGURE 1

Description.—Winged adult: Head castaneous-brown, with reddish tinge, epicranial suture with a V-shaped marking, head with scattered very long bristles and shorter hairs. Eye black, not round, very large, separated from lateral margins of head by a distance less than half its diameter. Ocellus white, oval, large, obliquely touching eye. Antennae with 18 or 19 segments, third segment shorter than second, but longer than fourth. Pronotum of similar color

and with similar pubescence as head, anterior margin shallowly concave, posterior margin nearly straight. Wings hyaline, veins near costal margin brown. In fore wing costa extending to over half length of wing, subcosta with 7 branches to upper margins, median not branching till near apex of wing, cubitus indistinct except near base, running about in middle of wing, with 14 main branches to lower margin of wing; in hind wing, median vein branched or biforked near base. Pulvillus present between claws. Abdomen castaneous-brown, long bristles at base of each tergite.

The eye is larger than in *fletcheri* Holmgren, compared with cotype material; also larger than in *greeni* Desneux.

Measurements.—Length of entire winged adult, 16–17 mm; length of entire dealated adult, 7–9 mm; length of head (to tip of labrum), 2.3 mm; length of pronotum, 1.15 mm; length of fore wing, 14 mm; length of wing scale, 1.5 mm; length of hind tibia, 1.7 mm; long diameter of eye, 0.7 mm; width of head (at eyes),

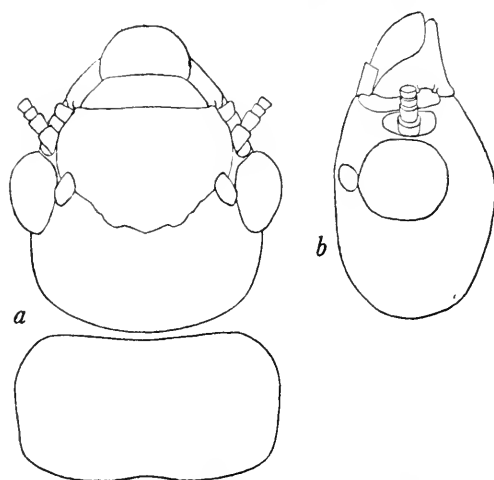


FIGURE 1.—*Kaloterмес (Neoterмес) gardneri*, new species: *a*, Dorsal view of head and pronotum; *b*, lateral view of head. Winged adult. $\times 18$

1.9 mm; width of pronotum, 2.15 mm; width of fore wing, 4.5 mm.

Type locality: Dehra Dun, United Provinces, India.

Cotypes.—Winged adults, tube 10, in British Museum; Forest Research Institute, Dehra Dun; and U.S.N.M. No. 44101.

Remarks.—Described from a small series of winged adults collected as nymphs at the type locality and reared by J. C. M. Gardner. “No. 1107, 13, IV, 1931 ex rotten *Mangifera indica*. R. R. D. 267, B. C. R. 116, Cage 724.” Named for the collector.

Family RHINOTERMITIDAE

HETEROTERMES MALABARICUS, new species

FIGURE 2

Description.—Winged adult: Head yellow-brown, with dense, light yellow, long bristles and shorter hairs. Fontanelle prominent, a pale, slightly raised, round spot on a line just back of eyes. Antennae yellow, usually with 14 segments, but the number ranging from 13 to 16; third segment usually shorter than second, but longer

than fourth, variable. Compound eye black, not round, separated from lateral margin of head by a distance less than its long diameter. Ocelli consistently absent. Postclypeus light yellow, bilobed, bulging, over three times as wide as long. Pronotum of same color as head, subcordate, not emarginate posteriorly but anterior margin indented in middle, with dense, long bristles and shorter hairs, not so long as wing scale (fig. 2). Mesonotum and metanotum convex, projected beyond wing scale. Wings smoky, margins ciliate, tissue punctate, hairs on surface. Median vein running nearer to middle of wing but closer to cubitus than subcosta, cubitus and branches taking up small area of wing. Abdomen with dense hairs, a row of longer bristles at base of each tergite.

Compared with cotype material of *H. indicola* and *ceylonicus* Holmgren, in cases of both winged and soldier castes: Fewer segments to antennae, and smaller eyes, which are farther from lateral margin of head than in *indicola*; closer to *ceylonicus* but fewer segments to antennae, third segment of antennae shorter than second, ocelli consistently absent, wings darker.

Measurements.—Length of entire winged adult, 9.5–9.75 mm; length of dealated adult, 5 mm; length of head (posterior to tip of labrum), 1.2 mm; length of pronotum, 0.5 mm; length of hind tibia, 0.9 mm; length of anterior wing, 7.55 mm; length of wing scale, 0.65 mm; width of head (at eyes), 0.8 mm; long diameter of eye, 0.2 mm; width of pronotum, 0.7 mm; width of anterior wing, 1.9 mm.

Soldier.—Head light yellow-brown, with scattered long bristles and shorter hairs. Antennae light yellow, 12 to 14 segments, third segment shorter than second. Gula over twice as wide at front as at narrowest point in middle. Pronotum emarginate anteriorly, nearly straight posteriorly.

In *ceylonicus*, the gula is proportionally wider at middle, and normally there are more segments to the antennae than in *malabaricus*; also the head and pronotum have sparser long bristles. In *malabaricus* the pronotum is distinct in both size and shape (fig. 2).

Measurements.—Length of entire soldier, 4.6 mm; length of head with mandibles, 2.4–2.5 mm; length of head without mandibles, 1.5 mm; length of left mandible, 0.9 mm; length of pronotum, 0.4 mm; length of hind tibia, 0.65 mm; width of head, 0.8–0.85 mm; width of pronotum, 0.6–0.65 mm.

Type locality.—S. Mangalore 400 feet, Malabar coast, Madras, India.

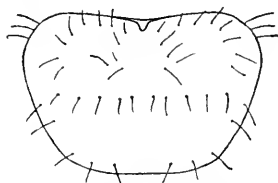


FIGURE 2.—*Heterotermes malabaricus*, new species: Dorsal view of pronotum of soldier. $\times 45$

Cotypes.—Winged adults; comorphotypes, soldiers, tube 13, in British Museum; Forest Research Institute, Dehra Dun, United Provinces, India; and U.S.N.M. No. 44102.

Remarks.—Described from a large series of winged adults collected at the type locality with soldiers and workers, by J. C. M. Gardner, 25, V, 1930.

Family TERMITIDAE

TERMES (TERMES) DEHRADUNI,
new species

FIGURE 3

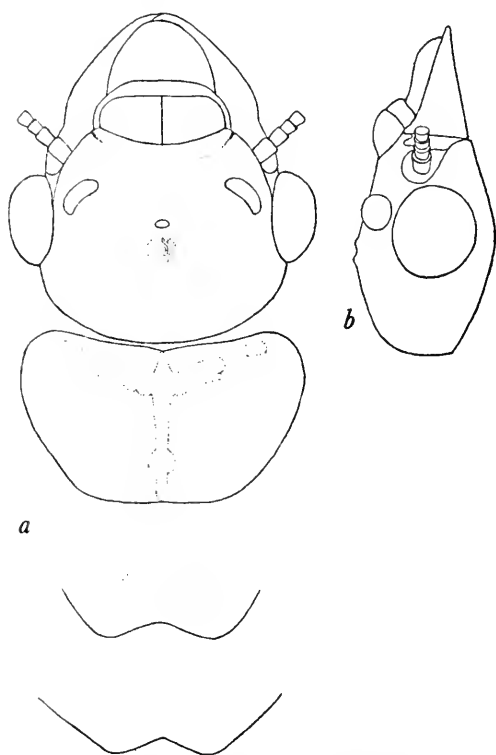


FIGURE 3.—*Termes (Termes) dehraduni*, new species: *a*, Dorsal view of head, pronotum, mesonotum, and metanotum; *b*, lateral view of head. Winged adult. $\times 18$

than third. Pronotum lighter colored than head, with long hairs, anterior margin medially notched, posterior margin nearly straight. T-shaped median marking on pronotum and one ocelluslike marking on each corner anteriorly. Mesonotum and metanotum broadly and shallowly emarginate posteriorly. Wings light colored, with yellowish costal area; tissue finely punctate, not hairy, margins ciliate. In fore wing, median branching from cubitus and closer to cubitus than to subcostal vein, branched to apex; cubitus occupying most of wing area. Abdominal tergites with long hairs and a white, suboval, slanting marking on each side of each tergite.

Description.—Winged adult: Head castaneous-brown, with fairly dense short and long hairs. Fontanelle a raised conical point, in front of which is a small suboval raised spot. Postclypeus yellow-brown, projecting, bilobed, without hairs in middle, less than half its width in length. Eyes black, large, projecting, close to lower margin of head. Ocelli white, large, projecting, close to eyes. Antennae with 19 segments, third, fourth, and fifth segments subequal, second segment longer

Measurements.—Length of entire winged adult, 24.5–26.5 mm; length of dealated adult, 12.5–14 mm; length of head (to tip of labrum), 2.5 mm; length of pronotum, 1.2 mm; length of fore wing, 20.05–21.25 mm; length of hind tibia, 2.4 mm; long diameter of eye, 0.65 mm; width of head (at eyes), 2.3–2.4 mm; width of pronotum, 2–2.1 mm; width of fore wing, 6.75 mm.

Type locality.—Dehra Dun, United Provinces, India.

Cotypes.—Winged adults, in United States National Museum (No. 44103) and in Forest Research Institute, Dehra Dun, United Provinces.

Remarks.—Described from a large series of winged adults collected at the type locality by J. C. M. Gardner, 29, VI, 1925.

TERMES (TERMES) MALABARICUS Holmgren

FIGURE 4

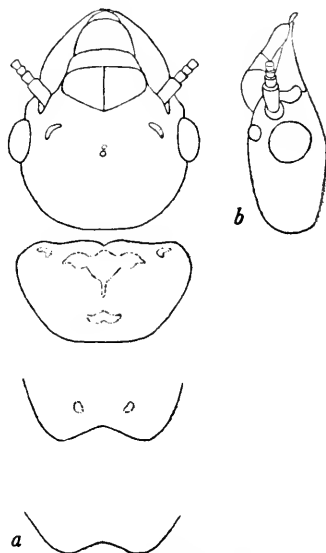


FIGURE 4.—*Termes (Termes) malabaricus* Holmgren: a, Dorsal view of head, pronotum, mesonotum, and metanotum; b, lateral view of head. Hitherto unknown winged adult. $\times 11$

Description.—Winged adult: Head castaneous-brown, with fairly dense short and long hairs. Fontanelle a slightly raised spot in front of which is a small white suboval spot. Postclypeus yellow-brown, projecting, medially bilobed, without hairs in middle, half its width in length. Eyes black, projecting, close to lower margin of head. Ocelli white, fairly large, projecting, separated from eyes by a distance equal to their short diameter. Antennae with 19 segments; third, fourth, and fifth segments subequal, second longer than third. Pronotum lighter colored than head, with longer hairs, anterior margin emarginate, slightly emarginate posteriorly. White “fleur de lis” median marking on pronotum and white suboval marking on each corner anteriorly. Mesonotum and metanotum broadly and shallowly emarginate posteriorly. Wings light colored, with yellowish costal area, tissue finely punctate, margins ciliate. In fore wing, median vein branching from cubitus and is closer to cubitus than to subcosta, branched to apex, cubitus occupying most of the area of the wing; subbranches of cubitus not so thick as in *T. (T.) dehraduni*. Abdomen with tergites having fairly dense long hairs and white markings similar to those in *dehraduni*.

Darker colored than *dehraduni*.

Measurements.—Length of entire winged adult, 22.5–23 mm; length of dealated adult, 11.5 mm; length of head (to tip of labrum), 2.55 mm; length of pronotum, 1.2 mm; length of fore wing, 19 mm; length of hind tibia, 2.4 mm; long diameter of eye, 0.5 mm; width of head (at eyes), 2.25 mm; width of pronotum, 2.1 mm; width of fore wing, 7 mm.

Soldier.—Head light yellow-brown, with scattered, fairly long hairs. Mandibles blackish with left mandible having small rudimentary, marginal tooth nearer to its base than to apex. Gula broad in middle. Antennae with 16 or 17 segments, second segment longer than third, third longer than fourth. Pronotum yellowish, markedly emarginate anteriorly and more broadly emarginate posteriorly, with long hairs. Abdominal tergites with long hairs.

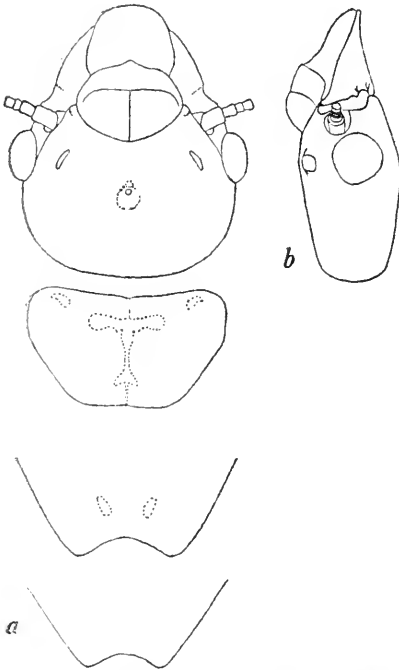


FIGURE 5.—*Termes (Cyclotermes) almorensis*, new species: *a*, Dorsal view of head, pronotum, mesonotum, and metanotum; *b*, lateral view of head. $\times 11$

Measurements.—Length of entire soldier, 5 mm; length of head with mandibles, 2.5 mm; length of head without mandibles (to anterior margin), 1.7 mm; length of pronotum, 0.6 mm; length of hind tibia, 1.1 mm; width of head, 1.3 mm; width of pronotum, 0.95 mm.

Remarks.—This species was based on the soldier caste, the winged adult being hitherto unknown. Described from a series of winged adults collected with soldiers and workers at Dehra Dun, United Provinces, India, 19,

VII, 1928, by J. C. M. Gardner and deposited in the United States National Museum and in the Forest Research Institute.

TERMES (CYCLOTERMES) ALMORENSIS, new species

FIGURE 5

Description.—Winged adult: Head castaneous-brown, with dense, long hairs. Fontanelle a small open (?) spot with ridged edges in a slightly sunken area surrounded by a lighter colored area, circular in shape and larger in diameter than an ocellus but smaller than an eye. Fontanelle not (?) elevated, with a suboval white spot in front, whole area depressed. Postclypeus yellow-brown, projecting. me-

dially bilobed, without hairs in middle and not quite half its width in length. Eyes black, large, projecting, close to lower margin of head. Ocelli white, rather small (only 0.23 mm long; 0.29 mm long in *distans*) but projecting, separated from eyes by a distance equal to or longer than their long diameter. Antennae with 18 or 19 segments, third, fourth, and fifth subequal, second segment longer than third. Pronotum slightly lighter colored than head, with long hairs; anterior margin medially notched, posterior margin shallowly emarginate. A T-shaped median marking on pronotum and one ocellus-like marking on each anterior corner. Mesonotum and metanotum slightly lighter in color than pronotum, broadly and shallowly emarginate posteriorly, an ocelluslike marking on each side of mesonotum. Wings "smoky" with yellowish-brown costal area; tissue finely punctate, margins ciliate. In fore wing, median vein arising from scale free from cubitus, running close to cubitus, and branched to apex. Cubitus with 10 or 11 main subbranches to lower margin, most of which are thick. Abdominal tergites with long hairs and a white suboval slanting spot on each side of each tergite.

Measurements.—Length of entire winged adult, 27–29 mm; length of dealated adult, 13 mm; length of head (to tip of labrum), 2.5 mm; length of pronotum, 1.25 mm; length of fore wing, 25 mm; length of hind tibia, 2.7 mm; long diameter of eye, 0.65 mm; width of head (at eyes), 2.8 mm; width of pronotum, 2.4 mm; width of fore wing, 6.5 mm.

Type locality.—West Almora Forest Division, United Provinces, India.

Cotypes.—Winged adults, U.S.N.M. No. 44104, and in Forest Research Institute, Dehra Dun.

Remarks.—Close to *T. (C.) distans* Holmgren, but smaller in all measurements; compared with cotype by Dr. A. E. Emerson. Described from a large series of winged adults collected at the type locality by H. G. Champion, May, 1919, altitude 5,000 feet.

MICROTERMES PUBESCENS, new species

Description.—Soldier: Head yellowish white, narrowed anteriorly, sloping front roughened or tuberculate, with dense hairs and scattered longer bristles. Fontanelle nearer to front than to posterior margin. Gula broad. Labrum extends to a distance two-thirds the length of the mandibles, narrow elongate, tapering anteriorly, with long bristles at tip. Mandibles castaneous-brown, darker at apex, slender, curved. Antennae with 14 segments, third segment shorter than second, subequal to fourth, second not quite so long as third plus fourth, fifth longer than third. Pronotum medially deeply incised at an acute angle anteriorly, emarginate posteriorly. Forelegs with subfossorial tibiae. Abdominal tergites with hairs and a row of longer bristles at the base of each tergite.

Measurements.—Length of entire soldier, 3.8 mm; length of head with mandibles, 1.5 mm; length of head without mandibles (to anterior margin), 1 mm; length of left mandible, 0.6 mm; length of pronotum, 0.3 mm; length of hind tibia, 0.7 mm; width of head, 0.8 mm; width of pronotum, 0.5 mm.

Type locality.—Dehra Dun, United Provinces, India.

Holotype.—Soldier, tube 15, British Museum.

Remarks.—More pubescent than *obesi* Holmgren; no apical tooth as in *globoicola* Wasmann, where antennae have 16 or 15 segments; smaller than *mycophagus* Desneux, also fewer segments to antennae; pronotum anteriorly strongly medially incised, whereas weakly incised in *incertoidea* Holmgren.

Described from one soldier collected with workers at the type locality by M. Bose, 31, VIII, 30, attacking aerial roots of *Ficus bengalensis*.

NASUTITERMES (NASUTITERMES) FLETCHERI Holmgren

Description.—Winged adult: Head castaneous-brown, postclypeus and antennae lighter colored. Head with dense short hairs and scattered longer bristles. Fontanelle a white narrowly oval spot with apex touching the lines outlining the epicranial suture at their convergence. Eyes black, large, projecting, very close to lateral margin of head. Ocelli large, projecting, oval, separated from eyes by a distance equal to their short diameter but less than their long diameter. Antennae with 15 segments, the second, third, and fourth segments subequal. Pronotum yellow with short hairs and longer bristles, slightly emarginate anteriorly and shallowly but broadly emarginate posteriorly. Mesonotum and metanotum broadly emarginate posteriorly. Wings grayish, margins ciliate, tissue punctate and densely hairy. In fore wing, median vein weakly defined and running close to cubitus, unbranched to apex; cubitus in middle of wing with 10 main branches to lower margin. Fore wing scale shorter than mesonotum. Abdomen with tergites brown, with dense long hairs.

Measurements.—Length of entire winged adult, 9 mm; length of dealated adult, 6.5 mm; length of head to tip of labrum, 1.3 mm; length of pronotum, 0.55 mm; length of fore wing, 9 mm; length of scale, 0.6 mm; length of hind tibia, 1.3 mm; long diameter of eye, 0.35 mm; width of head (at eyes), 1.2 mm; width of pronotum, 0.9 mm; width of fore wing, 2.8 mm.

Remarks.—*Nasutitermes* (*N.*) *fletcheri* was described by Holmgren from the soldier caste: hitherto the winged adult has been unknown. The winged adult of *N.* (*N.*) *matagensis* has a larger eye.

Described from a large series of winged adults collected with soldiers and workers at Anamalai Hills, 2,400 feet, Madras, 8, V, 1930, by J. C. M. Gardner. These soldiers appear to be identical with the cotype except that the bristles at the base of the tergites appear to be more distinct and longer than in the cotype. They were infected with a fungous disease (pl. 1).

Specimens in tube 12, Forest Research Institute, and in the United States National Museum.

NASUTITERMES (ROTUNDITERMES) ANAMALAIENSIS, new species

FIGURE 6

Description.—Soldier: Head yellowish, round, with very short hairs and with two rows of bristles; nasus reddish brown, short, cylindrical. Mandibles with a short point near base (fig. 6). An-

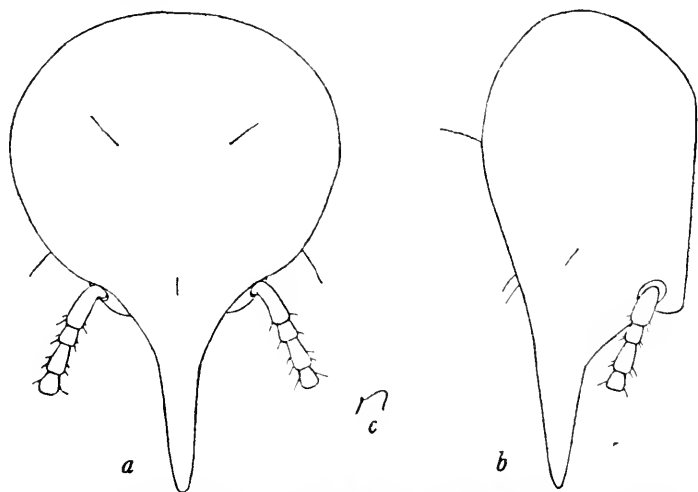


FIGURE 6.—*Nasutitermes (Rotunditermes) anamalaiensis*, new species: a, Dorsal, and b, lateral, views of head of soldier. $\times 37$. c, View of mandible, greatly enlarged

tennae with 12 or 13 segments, third segment always longer than the second, fourth, or fifth segments, sometimes nearly as long as fourth and fifth. Pronotum yellow, darker, and emarginate anteriorly. Abdomen dirty gray, tergites with short hairs, and a row of bristles at the base of each tergite.

Measurements.—Length of entire soldier, 4 mm; length of head with nasus, 1.9 mm; length of head without nasus (to anterior margin), 1.15 mm; length of nasus, 0.75 mm; length of pronotum, 0.25 mm; length of hind tibia, 1.3 mm; width of head, 1.2 mm; width of pronotum, 0.5 mm.

Type locality.—Anamalai Hills, 2,400 feet, Madras.

Cotypes.—Soldiers, tube 5, in British Museum, Forest Research Institute, Dehra Dun, United Provinces, India, and U.S.N.M. No. 44105.

Remarks.—Smaller than *crassicornis* Holmgren; *crassicornis* has usually one more segment to the antennae, 13 or 14, and a longer hind tibia; both are species in the subgenus *Rotunditermes*, whereas *matangensis* Haviland has a point at the apex of the mandible and is a *Nasutitermes* sensu strictu. Compared with cotypes of *crassicornis* and *matangensis*.

Described from a large series of soldiers collected with workers at the type locality by J. C. M. Gardner, 5, V, 1930.

NASUTITERMES (SUBULITERMES) GARDNERI, new species

Description.—Soldier: Head yellow-brown with a reddish tinge, paler posteriorly; nasus more reddish. Head and nasus in profile nearly straight, weakly concave; head not constricted back of antennae. Two long bristles on vertex of head and two shorter bristles at base of nasus. No point to the mandible. Nasus not so long as head, fairly slender, and more cylindrical than conical. Antennae with 13 segments, third segment nearly twice as long as second, second longer than fourth. Pronotum yellowish white, darker anteriorly, notched medially anteriorly and very shallowly emarginate posteriorly. Pronotum with short hairs and longer bristles on margins. Abdomen pale yellowish white; tergites with a row of long bristles at base and shorter hairs.

Distinct, because of the 13-segmented antennae.

Measurements.—Length of entire soldier, 3.5–3.85 mm; length of head and nasus, 1.7 mm; length of head without nasus, 1 mm; length of nasus, 0.7 mm; length of pronotum, 0.2 mm; length of hind tibia, 1.2 mm; width of head (where widest), 1 mm; width of pronotum, 0.5 mm.

Worker: Postclypeus nearly three times as wide as long.

Type locality.—Rangirum, Darjeeling, Bengal, India.

Cotypes.—Soldiers, tube 25, in British Museum; Forest Research Institute, Dehra Dun, United Provinces, India; and U.S.N.M. No. 44579.

Remarks.—Described from a series of soldiers collected with workers in rotten wood at an elevation of 6,000 feet by J. C. M. Gardner, 6, IX, 1929.

MICROCEROTERMES BEESONI, new species

FIGURE 7

Description.—Winged adult: Head dark castaneous-brown, with dense, fairly long hairs. Eye black, not round, separated from lower margin of head by a distance less than its diameter. Ocellus white, small, oval, separated from the eye by a distance about equal to the

long diameter of an ocellus. Fontanelle not visible, or a small point at the convergence of two lines from the ocelli to the apex of the head, that is, the outlines of the epicranial suture. Postclypeus lighter colored than head, large, raised, divided medially, twice as wide as long, wider than in *heimi* Wasmann. Antennae with 14 segments, third segment shorter than second or fourth. Pronotum of about same color as head, anterior margin straight, posterior margin nearly straight, with long bristles. Mesonotum and metanotum usually plainly emarginate, but variable. Wings dark, tissue punctate and with fairly dense hairs. In fore wing the median vein leaves the stub free and runs nearer to the cubitus than to the subcosta and is single or branched near apex of wing. Cubitus with nine branches to lower margin, of which the first five are thickened, but variable. Tibiae brownish. Abdomen lighter colored than head, tergites with dense hairs and a row of long bristles at base of each tergite.

Measurements.—Length of entire winged adult, 7.75–8.5 mm; length of dealated adult, 5–6 mm; length of head (to tip of labrum), 1.05–1.1 mm; length of pronotum, 0.4 mm; length of fore wing, 6.8 mm; length of hind tibia, 0.8 mm; long diameter of eye, 0.2 mm; width of head (at eyes), 0.8–0.85 mm; width of pronotum, 0.65–0.7 mm; width of fore wing, 1.7 mm.

Type locality.—Chakata Range, Haldwani, United Provinces, India.

Cotypes.—Winged adults, tube 21, British Museum; in Forest Research Institute, Dehra Dun, United Provinces, India, and U. S. N. M. No. 44106.

Remarks.—Head darker colored, ocelli larger, oval, and closer to eyes than in *heimi*, where they are round and more distant from eyes. Smaller than *annandalei* Silvestri. This may be the winged form of a termite described from the soldier caste alone.

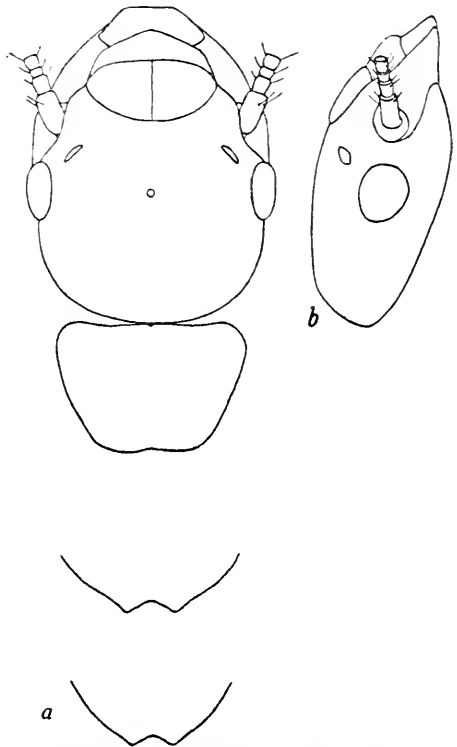


FIGURE 7.—*Microcrotermes becconi*, new species: a, Dorsal view of head, pronotum, mesonotum, and metanotum; b, lateral view of head. Winged adult. $\times 40$

Described from a series of winged adults collected on the wing at the type locality by S. V. Chatterjee, VII, 1930. Named for C. F. C. Beeson, forest entomologist, Forest Research Institute, Dehra Dun, India.

MICROCEROTERMES CHAMPIONI, new species

FIGURE 8

Description.—Winged adult: Head dark castaneous-brown, with fairly dense short hairs and longer bristles. Eyes black, nearly round, separated from lateral margin of head by a distance less than their diameter. Ocelli white, fairly large, oval, separated from eyes by a distance less than the long diameter of an ocellus. Fontanelle not visible, or a raised white spot at the convergence of two lines from the ocelli to apex of head, or the outlines of the epicranial suture. Postclypeus lighter colored than head, raised up, with a median line, about twice as broad as long—broader than in *heimi* Wasmann. Antennae with 14 segments, third segment smaller than fourth, second as long as third and fourth. Pronotum of same color and with same pubescence as head, posterior margin nearly straight. Mesonotum and metanotum slightly emarginate posteriorly. Wings smoky gray, margins white, tissue densely punctate, and with fairly dense hairs. In fore wing, median vein closer to cubitus than to subcosta, branched to apex; cubitus with 10 branches to lower margin, 8 of which are thickened. Tibiae yellow-brown. Abdomen lighter colored than head, with dense hairs and a row of longer bristles at the base of each tergite.

Ocelli slightly larger than in *beesoni*; eyes slightly smaller, pronotum long. Ocelli larger than in *heimi* Wasmann, closer to eyes, head and postclypeus darker colored, pronotum longer, tibia lighter

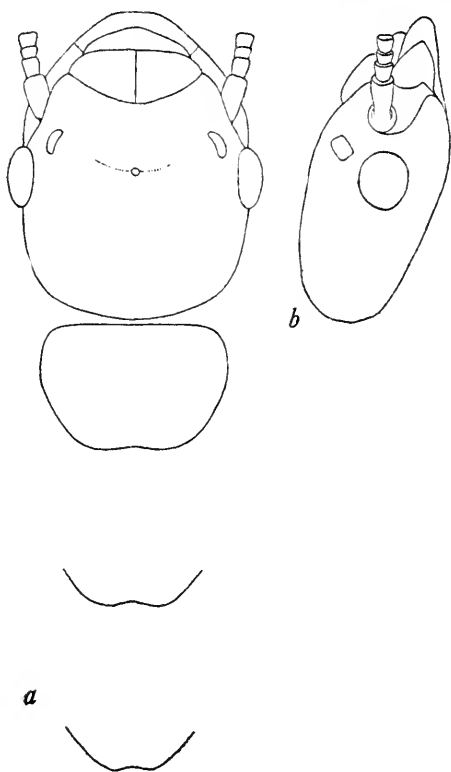


FIGURE 8.—*Microcerotermes championi*, new species: *a*, Dorsal view of head, pronotum, mesonotum, and metanotum; *b*, lateral view of head. Winged adult. $\times 40$

fairly dense hairs. In fore wing, median vein closer to cubitus than to subcosta, branched to apex; cubitus with 10 branches to lower margin, 8 of which are thickened. Tibiae yellow-brown. Abdomen lighter colored than head, with dense hairs and a row of longer bristles at the base of each tergite.

Ocelli slightly larger than in *beesoni*; eyes slightly smaller, pronotum long. Ocelli larger than in *heimi* Wasmann, closer to eyes, head and postclypeus darker colored, pronotum longer, tibia lighter

colored. Compared with cotype material. Smaller than *annandalei* Silvestri.

Measurements.—Length of entire winged adult, 7.5–8.5 mm; length of dealated adult, 4.8–5 mm; length of head (to tip of labrum), 1.1 mm; length of pronotum, 0.4–0.45 mm; length of fore wing, 6.25 mm; length of hind tibia, 0.85 mm; long diameter of eye, 0.175 mm; width of head (at eyes), 0.82 mm; width of pronotum, 0.6 mm; width of fore wing, 1.5 mm.

Soldier.—Head light yellow-brown to darker, with few hairs. Antennae with 13 segments, third as in *heimi*. Pronotum with anterior margin notched in middle, posteriorly nearly straight. Abdomen with fairly dense hairs and a row of longer hairs at the base of each tergite.

Measurements.—Length of entire soldier, 4.5 mm; length of head and mandibles, 2.2–2.3 mm; length of head without mandibles, 1.4–1.5 mm; length of left mandible, 0.8 mm; length of pronotum, 0.3 mm; length of hind tibia, 0.65 mm; width of head, 0.9 mm; width of pronotum, 0.55 mm.

Type locality.—Haldwani district, Kumaon, United Provinces, India.

Cotypes.—Winged adults, U.S.N.M. No. 44107. Comorphotypes, soldiers, United States National Museum. Both cotypes and comorphotypes in British Museum and Forest Research Institute, Dehra Dun, United Provinces, India.

Remarks.—Very close to *heimi*, darker colored, pronotum more distinctly notched in middle anteriorly, gula narrower in middle; soldier larger than that of *greeni* Holmgren.

Described from a series of winged adults collected with soldiers, workers, and 11 physogastric, macropterous queens at the type locality, 14, 6, 23, by H. G. Champion, for whom this termite is named.



FUNGUS DISEASE (TERMITARIA SP.) ON FORELEG OF THE TERMITE NASUTITERMES (N.) FLETCHERI HOLMGREN, FROM ANAMALAI HILLS, INDIA

Photos by J. G. Pratt. Greatly enlarged.

A NEW NEMATODE FROM THE RHEA

By EVERETT E. WEHR

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On April 22, 1927, Dr. E. W. Price, of the zoological division, collected a number of nematodes from the gizzard and proventriculus of a bird (*Rhea americana*) that had died at the National Zoological Park, Washington, D. C. The males of these nematodes are of particular interest in that they possess remarkably long and slender spicules, which are equal in length and similar in appearance. As one of the diagnostic characters of the superfamily Spiruroidea is the possession of dissimilar spicules, and as this nematode must go in the Spiruroidea by virtue of its other characters, the definition of the superfamily will have to be emended to include this genus, the emendation covering the presence of either similar or dissimilar spicules. The definition of the family Spiruridae will also have to be emended to include this character, as the new genus *Odontospirura*, herein described, belongs to that family.

Family SPIRURIDAE Oerley, 1885

Family diagnosis.—Spiruroidea: Mouth usually with two large lateral lips. Esophagus long and cylindrical and divided into two parts. Male with caudal alae well developed and supported by pedunculated papillae, of which there are usually four preanal pairs; spicules usually dissimilar and unequal, sometimes similar and equal.

Subfamily SPIRURINAE Railliet, 1915

Subfamily diagnosis.—Spiruridae: Characters of the family.

ODONTOSPIRURA, new genus

Generic diagnosis.—Spirurinae: Mouth opening surrounded by two large lateral lips and by two interlabia in the dorsal and ventral fields, respectively. Four pairs of cephalic papillae are present in the submedian fields, the two most dorsal and the two most ventral of which are greatly reduced in size; the papillae are near the base

of the lips, while the amphids are on the lateral lips, at a level slightly anterior to the papillae. At least one lateral ala may be present. Cervical papillae just posterior to nerve ring. Male with caudal alae; spicules very long, equal or nearly equal in length, and similar. Caudal extremity pointed in both sexes. Gubernaculum present.

Type species.—*Odontospirura cetiopenis*, new species.

ODONTOSPIRURA CETIOPENIS, new species

FIGURES 1-3

Specific diagnosis.—*Odontospirura*: Body spirally coiled, sometimes in the shape of a corkscrew. Only one lateral ala present, on

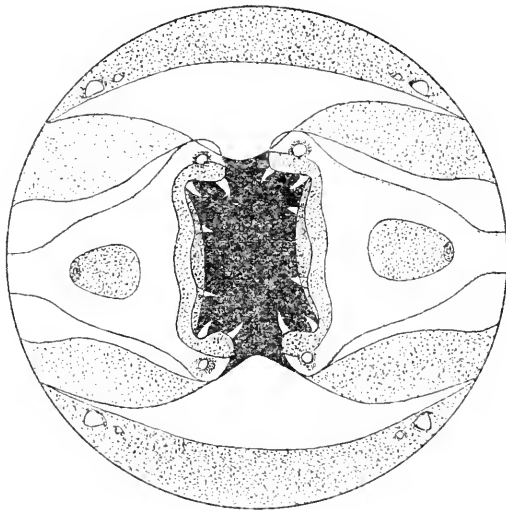


FIGURE 1.—*Odontospirura cetiopenis*, new species:
En face view of head

left side of body; it can be distinctly traced for about two-thirds the length of the body. Each of the lateral lips bears six conspicuous teeth on its inner edge.

Male, 15 mm to 17 mm long by 500μ wide in maximum width. Esophagus divided into two distinct parts, an anterior muscular part 430μ long and a posterior glandular part 3.55 mm long. Nerve ring about 360μ from anterior end of body. Cervical papillae 440μ from anterior end of body. Head distinctly set off from rest of body by a constriction at the base of the lips. Mouth opens into a short buccal cavity, the length of which equals approximately the height of the head. Caudal alae supported by four pairs of preanal and two pairs of postanal pedunculate papillae; a pair of sessile papillae

is located about midway between the anal opening and the posterior end of the body, and five or six other papillae, smaller in size and sessile, are to be seen near the posterior tip of the caudal alae. Spicules similar and very slender, equal or nearly equal in size, and about 10 to 11 μ long, this length being unusual for nematodes of the size of these. In most of the male specimens that were examined the spicules were extruded from the body for more than half their length, but in the type specimen one of the spicules remained unprotruded from the body and could be seen to extend from near the posterior end of the esophagus to the cloacal opening. Gubernaculum present, 1.08 mm long, triangular in shape in ventral view.

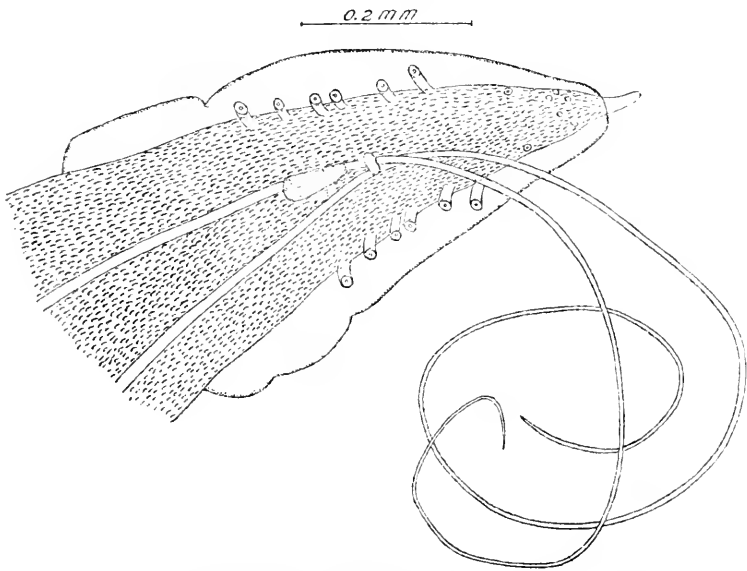


FIGURE 2.—*Odontospirura cetiopenis*, new species: Ventral view of male tail

Female, 20 mm to 23 mm long by 572μ wide in maximum width. The anterior end of body of most of the preserved specimens is slightly coiled. Anterior muscular part of esophagus 472μ long; posterior glandular part 3.6 mm long; latter portion a little broader than former. Nerve ring about 363μ from anterior end of body. Cervical papillae 447μ from anterior end of body. Vulva about 9.8 mm from anterior end of body. Anus prominent, 430μ from posterior end of body. Caudal extremity abruptly narrowed just posterior to anal opening; from there it gradually narrows to a blunt point. Eggs embryonated, 46μ long by 17μ wide.

Host.—*Rhea americana* (Linnaeus).

Location.—Proventriculus and gizzard.

Distribution.—National Zoological Park, Washington, D. C.

Type specimen.—U.S.N.M. Helm. Coll. No. 27583.

Remarks.—The presence of a dorsal and a ventral interlabium and two well-developed lateral lips, with the cephalic papillae situated near the bases of the lips, and the character of the male tail place this species definitely in the family Spiruridae. The possession of a dorsal and a ventral interlabium, and of a short chitinous buccal cavity, and the position of the vulva near the middle region of the body suggest its relation to the genus *Habronema*. The position of the cervical papillae, posterior to the nerve ring, and the length and character of the spicules of the male seem to warrant the erection of a new genus for this species.

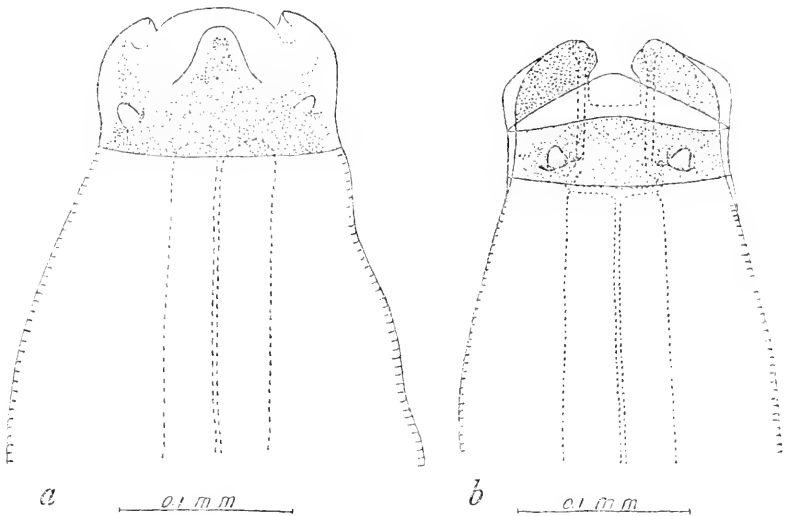


FIGURE 3.—*Odontospirura cetiopenis*: a, Lateral view of head; b, dorsal view of head

Cram (1927) lists two species of nematodes, *Spirura zschokkei* and *S. uncinipenis*, as being collected from the proventriculus of *Rhea americana*. The first species, which was called *Spiroptera alata* by Zschokke (1889), was later renamed *Spirura zschokkei* by Railliet and Henry in 1911, on the basis that the original name was pre-occupied by *Spiroptera alata* Rudolphi, 1819. Unfortunately Zschokke failed to give a complete description of this male specimen which he collected, as the number of caudal papillae and the length and character of the spicules were not given. More unfortunate than this, perhaps, is the fact that he did not figure any portion of the worm. The much greater length of the male of *S. zschokkei*, as given by Zschokke in his original description of this species, and

the presence of two lateral alae, which extend the entire length of the body, and of four chitinous teeth surrounding the mouth cavity differentiate *S. zschokkei* and the species here described as new. As regards *S. uncinipennis* (Molin, 1860), which has been redescribed and placed in the genus *Habronema* by Walton (1927), the dissimilar and very unequal spicules of this species, the different number and arrangement of caudal papillae of the male, the differently shaped interlabia, and other distinctions noted in an *en face* view of the heads readily separate it from the present species.

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SYNOPSIS OF THE CALANOID CRUSTACEANS, EXCLUSIVE OF THE DIAPTOMIDAE, FOUND IN FRESH AND BRACKISH WATERS, CHIEFLY OF NORTH AMERICA

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The term Calanoida for a suborder of Copepoda is used herein as defined by G. O. Sars. The calanoid species found in North and South America are in the families Centropagidae, Diaptomidae, Pseudodiaptomidae, Senecellidae, and Temoridae. Though this paper is intended specifically to cover the forms of North America, the discussion of species is not limited to those of that continent, but in some cases includes those of the world.

Among the Centropagidae of North America are found the genera *Limnocalanus* and *Osphranticum*. The Temoridae of North America include the genera *Eurytemora*, *Hetercope*, and *Epischura*. The family Pseudodiaptomidae includes the genera *Pseudodiaptomus* and *Schmackeria*. The new family Senecellidae has only one genus, *Senecella*.

KEY TO THE GENERA OF THE FRESH-WATER CALANOIDA

- | | |
|--|------------------|
| 1. Endopods of feet 1 to 5, 2-segmented..... | Calamoecia Brady |
| Endopods of feet 1 to 4, 1-segmented, fifth feet of female without endopods..... | 2 |
| Endopods of first feet, 1-segmented; feet 2 to 4, 2-segmented..... | 3 |
| Endopods of feet 1 to 4, 3-segmented..... | 4 |
| Endopods of feet 1 to 5, 3-segmented..... | 7 |
| Endopods of first feet, 2-segmented; feet 2 to 4, 3-segmented; endopods of female fifth feet, 2-segmented..... | 9 |
| Endopods of first feet, 1-segmented; second feet, 2-segmented; third and fourth feet, 3-segmented..... | Senecella Juday |
| 2. Abdomen of male symmetrical, distal segment of exopod of female fifth foot terminating in a long spine..... | Hetercope Sars |
| Abdomen of male asymmetrical, distal segment of exopod of female fifth foot not terminating in a spine..... | Epischura Forbes |

¹ Doctor Marsh died on Apr. 23, 1932, just one month after this paper was submitted for publication. A complete list of Doctor Marsh's copepod papers is given on pp. 57 and 58.—EDITOR.

3. Exopods of feet 1 to 4, 3-segmented; in female fifth feet endopods 2-segmented..... *Brunella* Smith
 Exopods of first feet, 1-segmented; feet 2 to 4, 2-segmented;
 female fifth feet without endopods..... *Eurytemora* Giesbrecht
4. First antennae 20- to 22-segmented..... 5
 First antennae 25-segmented..... 6
5. Second segment of basipod of left fifth foot of male with long curved projection from inner border.... *Schmackeria* Poppe and Richard
 Second segment of basipod of left fifth foot of male without long curved projection from inner border..... *Pseudodiaptomus* Herrick
6. Female fifth feet without endopods, male fifth feet with terminal hook on right foot only, and hook turned outward instead of inward..... *Poppella* Richard
 Female fifth feet with endopods, male fifth feet with terminal hook on both exopods..... 10
 Female fifth feet with endopods, male fifth feet with terminal hook on right exopod only, fourth feet with a long curved spine on inner distal angle on first basal segment.... *Gladioferens* Henry
7. Exopods of second antennae 5-segmented, segments 2, 3, and 4 being short..... *Parabroteas* Mrázek²
 Exopods of second antennae 6-segmented, segments 2 to 5 being short..... *Sinocalanus* Burckhardt
 Exopods of second antennae 7-segmented, segments 1, 3, 4, 5, and 6 being short..... 8
8. Furca short..... *Osphranticum* Forbes
 Furca long..... *Limnocalanus* Sars
9. In male fifth feet both exopods terminating in an elongated hook; in female fifth feet exopods distinctly 3-segmented. *Metaboeckella* Ekman³
 In male fifth feet only right exopod terminating in an elongated hook; in female fifth feet third segments of exopods are either rudimentary or lacking..... 11
10. Endopod of right fifth foot of male rudimentary, 1- to 3-segmented, without setae..... *Boeckella* de Guerne and Richard
 Endopod of right fifth foot of male 3-segmented, with setae. *Pseudoboeckella* Mrázek
11. Female abdomen 2-segmented, maxillipeds prominent..... 12
 Female abdomen 3-segmented, maxillipeds not prominent..... 13
12. Left exopod of male fifth foot armed with hook and acute spine. *Lovenula* Schmeil⁴
 Left exopod of male fifth foot armed with two stout spines and hyaline lamella..... *Paradiaptomus* Sars
13. Exopod of left fifth foot of male with stout curved spine in posterior surface and a small terminal spine... *Metadiaptomus* Methuen
 Exopod of left fifth foot of male armed with two small appendages that may be either digitate or spiniform... *Diaptomus* Westwood⁵

² Synonyms: *Limnocalanus* Daday, *Gigantella* Ekman, *Parabroteas* Ekman.

³ Synonym: *Boeckella* (*dilatata*) Sars.

⁴ Synonym: *Adiaptomus* Cooper.

⁵ Synonym: *Hemidiaptomus* Sars.

Family CENTROPAGIDAE

Genus LIMNOCALANUS Sars, 1863

Body long and narrow. The cephalothorax is composed of six segments, is elongated oval in form, with its greatest width at about the middle. The last cephalothoracic segment is not produced laterally. The abdomen is slender, composed of three segments in the female and five in the male. The furcal rami are elongated, ciliate on the internal margins; they are terminated by five elongated setae, of which the second from the inside is the longest, and one short slender seta on the inner margin. The external seta is located back of the end of the ramus. The first antennae are 25-segmented, the terminal segment being very short.

The right antenna of the male is geniculated and composed of 22 segments; of the normal 25 segments, 19 to 21 and 22 to 23 are united. The terminal portion is composed of four or five segments. In *L. macrurus* and *L. johanseni*, the typical form of this terminal portion is that shown in Plate 1, Figure 8; the first of the group, the nineteenth segment of the antenna, is elongated, the second somewhat shorter, the third less than half the length of the second, and the terminal one very short. In exceptional cases in both these species the first segment is divided as shown in Plate 1, Figure 9. In all examined specimens of *L. grimaldii* there have been five segments, as in Figure 9. Both Sars (1897) and Willey (1923) give the number of segments as five.

In the second antennae (pl. 1, fig. 5) the exopod is longer than the endopod and is composed of seven segments, of which the first and the third, fourth, fifth, and sixth are short. All the swimming feet are biramose, the fifth pair both in the male and female differing from the others. Both rami of feet 1 to 4 are 3-segmented, the endopods being shorter than the exopods. The outer rami of the fifth pair of the female are 3-segmented, and the second segment is produced on the inner distal angle into a stout curved process. (Pl. 3, fig. 3.)

The exopods of the fifth feet of the male (pl. 13, fig. 5) are 2- or 3-segmented. The second segment of the right exopod is short, truncated, and produced on the inner side into a stout hook. The second segment of the left exopod is elongate, ciliate on the inner border, and in addition to a terminal spine bears three lateral spines on the outer border.

KEY TO THE SPECIES OF LIMNOCALANUS

1. Both exopods of male fifth feet 2-segmented, length of furcal rami about seven times width..... 2
 Right exopod of male fifth feet distinctly 3-segmented, length of furcal rami about three times width..... *johanseni* Marsh
2. Head distinctly vaulted, with a cervical depression; sides of last thoracic segment rounded; female antennae hardly reaching second abdominal segment. Fresh water..... *macrurus* Sars
 Head not distinctly vaulted, no cervical depression; sides of last thoracic segment pointed; female antennae extending to base of furca. Marine and brackish water..... *grimaldii* (de Guerne)

LIMNOCALANUS MACRURUS Sars

PLATE 1, FIGURES 2, 3, 5; PLATE 2; PLATE 3, FIGURES 1-3; PLATE 13, FIGURE 5

Limnocalanus macrurus Sars, 1863, pp. 228, 229; 1903, pp. 81-83, pls. 55, 56.—FORBES, 1882, p. 648.—NORDQUIST, 1888, pp. 31-37, pl. 1, figs. 9-11, pl. 2, figs. 1-5, pl. 3, figs. 1-4.—DE GUERNE and RICHARD, 1889, p. 77, pl. 4, figs. 5, 11, 12.—HERRICK and TURNER, 1895, p. 49, pl. 1, figs. 1-4.—SCHACHT, 1898, pp. 238-244.—GIESBRECHT and SCHMEIL, 1898, pp. 58, 59.—MARSH, 1918, p. 774, fig. 1212.

Limnocalanus macrurus var. *auctus* FORBES, 1891, pp. 796, 707.—MARSH, 1893, p. 201, pl. 4, fig. 7; 1895, pp. 11, 12, pl. 4, figs. 1, 2, pl. 5, figs. 1-3.

Limnocalanus grimaldii var. *macrurus* RYLOV, 1922, pp. 13, 14, fig. 5, *a-d*; 1930, pp. 64-69, fig. 5, 1 and 2, fig. 13, 3 and 4, fig. 15, 1-3.

The head, seen in profile, is distinctly vaulted, and there is a more or less clearly marked cervical depression. (Pl. 1, figs. 2, 3.) The last cephalothoracic segment is not broadened, and its sides are rounded. There are spines on the distal border of the second abdominal segment of the female and on segments 2 to 4 of the male. The length of the furcal rami is about seven times the width. The first antennae hardly reach the second abdominal segment. The armature of the first antennae of the male is shown in Plate 2. The exopod of the second antenna has the typical form of the genus. (Pl. 1, fig. 5.)

In Plate 3, Figures 1 and 2, are shown the swimming feet 1 and 2, and in Figure 3 the fifth foot of the female.

In the male fifth foot (pl. 13, fig. 5), the right exopod is 2-segmented, but the second segment has a projection that may be considered as a rudimentary third segment; the right exopod and endopod are of about equal length. The left exopod is larger than the endopod.

The size, as given by different authors, varies somewhat: Females, 2.2 to 3.15 mm; males, 2.2 to 2.78 mm.

This species is considered a fresh-water form. It occurs in many localities in Scandinavia and in Finland. In America it is in all the Great Lakes, in Green Lake, Wis., and in Lake Nipigon, Canada.

Birge and Juday (1914) found it in Cayuga, Seneca, Canandaigua, Skaneateles, and Owasco Lakes in New York. Bajkov (1930) reported it from Lake Winnipeg. Stephensen (1913) and Haberbosch (1916) reported it from Greenland.

The description of this species and of the genus is largely from the original account by Sars, but modified somewhat by the results of later investigations. The enlarged head and cervical depression are certainly not so marked in American material as is indicated by the figures by Sars, but this peculiarity is less marked in Nordquist's drawings. In Plate 1, Figure 2, it is much less marked than in Figure 3.

There is some lack of agreement in regard to the number of segments in the exopod of the second antenna. This was discussed by Schacht (1898), and he is correct in considering the exopod as 7-segmented, not only in *L. macrurus* but in the genus; it is evident that the lack of agreement is due to the indistinctness with which the separation of the middle segments is marked.

Remarks.—*L. macrurus* is generally considered as belonging to the *fauna relicta*; that is, it is a salt-water form that has gradually become adapted to a fresh-water environment. Generally speaking, it is found only in fairly deep lakes and most abundantly at considerable depths. Its habits with relation to temperature and light are discussed by Marsh, 1897 (pp. 200-202). Rylov (1922 and 1930) lists this species as *L. grimaldii* var. *macrurus*. As there is no available translation of his Russian text, I can not state why he has made this change.

LIMNOCALANUS GRIMALDII (de Guerne)

PLATE 1. FIGURES 4, 6, 7

Centropages grimaldii DE GUERNE, 1886, pp. 276-285.

Limnocalanus macrurus NORDQUIST, 1888, p. 31.—DE GUERNE and RICHARD, 1889, pp. 77, 78.—SCHACHT, 1898, p. 243.

Limnocalanus grimaldii SARS, 1897, pp. 39-49, pl. 4, figs. 1-18; 1898, p. 12, pl. 8, fig. 7.—WILLEY, 1920, p. 11K.—PESTA, 1928, p. 27, fig. 19, a-c.—RYLOV, 1930, pp. 63, 64, fig. 13, 1 and 2, fig. 14, 1 and 2.

L. grimaldii differs from *L. macrurus* in the characters given in the key, that is, in the flat head with no cervical depression, in the pointed sides of the last cephalothoracic segment, and in the greater length of the female antennae. While the number of segments in the terminal portion of the right antenna of the male is typically in *L. macrurus* four and, exceptionally, five, it appears to be in *L. grimaldii* always five, as shown in Plate 1, Figure 7. In other respects *L. grimaldii* is identical with *L. macrurus*.

Plate 1, Figure 6, shows the right fifth foot of the male, Figure 4 exopod of left fifth foot, and Figure 7 fifth foot of female.

Remarks.—Nordquist (1888), de Guerne and Richard (1889), and Schacht (1898) considered that there is not sufficient difference to warrant the adoption of another specific name. It is a fact, however, that the differences as given above exist, and it is probably best to recognize them by a specific name.

This species was originally described from material collected in the Gulf of Finland. It has been found in many parts of the eastern Baltic as well as the Gulf of Finland and the Gulf of Bothnia, on Kolguev Island in the Kara Sea, at the mouth of the Jana, in the sea off Spitsbergen, and in Greenland. Sars found it in the Caspian Sea and in 1897 gave a detailed description of it. Willey (1920) reported it from Collinson Point, Alaska; this collection was made by Frits Johansen in the Arctic Ocean, about 100 yards from shore in about 1 fathom of water. *L. johanseni* was collected inland from that point in a pond about 4 feet deep; this pond apparently had no connection with the ocean, and the location where *L. grimaldii* was collected was not connected in any way with fresh water. Willey (1923) reported finding *L. grimaldii* in large numbers in the stomach contents of the capelin (*Mallotus villosus*).

Sars (1898) stated that the specimens from the mouth of the Jana were much larger than those from the Caspian, and expressed his belief that *L. grimaldii* is a more Arctic form and that its presence in the Baltic and Caspian Seas is evidence of a former connection of those basins with the Arctic. Its occurrence at the mouth of the Jana, in the Kara Sea, at Kolguev Island, Spitsbergen, Greenland, and Collinson Point would indicate a wide distribution in the Arctic.

The size of the male, as given by different authors, is 2 to 2.5 mm; of the female, 2.8 to 3.6 mm.

The segmentation regeneration of the terminal part of the right antenna of the male is discussed under the description of the genus.

LIMNOCALANUS JOHANSENI Marsh

PLATE 1, FIGURES 1, 8, 9; PLATE 3, FIGURES 4-7; PLATE 13, FIGURE 6

Limnocalanus johanseni MARSH, 1920, pp. 3j-4j, pl. 1, figs. 1-8.

The head, as shown in Plate 1, Figure 1, is not vaulted as in *L. macrurus*. The front is armed with two projections. The last cephalothoracic segment is rounded on the sides and each side is armed with a small spine, which may be sharp, as in Plate 3, Figure 5, or blunt, as in Plate 3, Figure 6.

In the abdomen of the female (pl. 13, fig. 6) the first segment is somewhat expanded laterally and is about twice as long as the second; the third segment is slightly longer than the second. The

length of the furcal rami is three times the width. They are about half again as long as the third segment. They are ciliate on the inner borders but not covered with coarse hairs or spines as in *L. macrurus*. In the male abdomen (pl. 3, fig. 4) the first three segments are nearly equal in length and the fourth and fifth are somewhat shorter.

The first antennae, when reflexed, reach the second abdominal segment. The terminal portion of the right antenna of the male is usually 4-segmented (pl. 1, fig. 8), but sometimes is 5-segmented (pl. 1, fig. 9). The other cephalothoracic appendages of the female are like *L. macrurus*.

The left fifth foot of the male (pl. 3, fig. 7) is like that of *L. macrurus*, but the terminal spine of the second segment of the exopod is somewhat longer. The exopod of the right fifth foot of the male is distinctly 3-segmented. The first segment has a spine at the outer distal angle. The second segment is prolonged into the customary hook at the inner distal angle; at the outer distal angle is a short, blunt, curved hook. The third segment is attached by a distinct joint just within the outer hook: It is hook-shaped, curved inward, pointed at the end, about twice the length of the second segment and one-third to one-half its width; it has upon its dorsal surface a curved spine.

Average length: Females, 2.99 mm; males, 2.6 mm.

Remarks.—*L. johanseni* has, so far, been found in only one locality, in a pond on the coast of the Arctic Sea at Collinson Point.

The distinguishing features of the species are the short furca armed with fine cilia rather than coarse hairs or spines and the 3-segmented exopod of the male right fifth foot.

Genus OSPHRANTICUM Forbes, 1882

Only one species of *Osphranticum* has been found; therefore the description of the species will serve also for the genus.

OSPHRANTICUM LABRONECTUM Forbes

PLATES 4, 5

Potomoichetor fucosus HERRICK, 1882, p. 224, pl. 2, figs. 12-14, pl. 3, figs. 1-3, 13, 14.

Osphranticum labronectum FORBES, 1882, p. 645, pl. 8, figs. 24, 28, 29, pl. 9, figs. 1, 2, 4, 5, 7, 9.—HERRICK, 1884, p. 134, pl. Q², figs. 1-8, 13, 14; 1887, p. 12.—DE GUERNE and RICHARD, 1889, pp. 96, 97, pl. 4, figs. 1, 2.—HERRICK and TURNER, 1895, p. 86, pl. 12, figs. 1-8, 13, 14, pl. 59, figs. 7, 8.—SCHACHT, 1898, pp. 230-235.—GIESBRECHT and SCHMEIL, 1898, p. 59.—TOLLINGER, 1911, pp. 151-153, fig. M¹.—JUDAY, 1915, p. 241.—MARSH, 1918, p. 774, fig. 1211.

The cephalothorax is symmetrically oval (pl. 4, fig. 1), composed of six segments, which decrease in length from before backward. The first segment about equals the three following segments. The last segment is bluntly rounded at the sides, and is not armed with spines.

The abdomen of the female (pl. 4, fig. 2) consists of four segments, decreasing in length from the front backward. The furcal rami about equal in length the third segment and are ciliate on the inner border. The egg sacs are very large, extending nearly to the ends of the furcal setae. The abdomen of the male (pl. 5, fig. 4) consists of five segments, the fifth being short, hardly half as long as the fourth. The furcal rami are ciliate. The furcal setae are long and plumose, the fourth from the outside being the longest. The antennae are 25-segmented and equal in length the cephalothorax or a little more. The right antenna of the male (pl. 4, fig. 3) is geniculate between the eighteenth and nineteenth segments. The antennae are richly supplied with sensory clubs. The segmentation of the second antennae (pl. 5, fig. 5) is like that of *Diaptomus* and *Limnocalanus*. The mandible is shown in Plate 4, Figure 5. Swimming feet 1 to 5 are biramose and in all the endopods are 3-segmented. There is a seta on the inner side of the first basal segment of all feet except the fifth.

The fifth feet of the female (pl. 5, fig. 1) are alike. The first basal segment is armed on the outer margin with a very delicate hair. The second segment is unarmed. The first and second segments of the exopod have a stout spine at the outer distal angle; the inner distal angle of the second segment is prolonged into a slightly curved lamellate hook, which reaches the end of the third segment. The third segment is armed with three spines and four setae; there is also a short acute terminal spine.

The first segment of the exopod is unarmed. The second segment has a long seta at the inner distal angle; the third segment has a lamellate spine on the outer margin and, on the inner margin and the end, five setae.

In the male the seta on the inner distal angle of the second segment of the exopod of the fourth foot is peculiar in that the base is much swollen, as shown in Plate 5, Figure 3, and the third segment of the exopod is hollowed out on the inner proximal angle to receive the base of this seta. In Plate 5, Figure 2, is shown for comparison the female fourth foot, in which there is a slight indication of this enlargement of the seta of the second segment of the exopod, but no modification of the inner proximal angle of the third segment.

Each of the second basal segments of the male fifth foot (pl. 4, fig. 4) is armed on the outer margin at about one-third its length with a short hair. The exopod of the right foot is 2-segmented; the first segment is trapezoidal in form, with a stout spine at the outer distal angle. The second segment is about three times as long as its width; it has a stout spine about one-half the length of the outer margin and three nearly equal terminal spines; these spines are nearly equal in length to the segment; the inner spine is slightly the longest and is slightly curved inward, while the other two are straight. This segment has on its inner proximal angle a prominent rounded pad covered with short hairs.

The left exopod is 3-segmented. Segments 1 and 2 are about twice as long as broad, and bear at the outer distal angles a rather slender spine about equal in length to the segment. The third segment is smaller than the first and second, about twice as long as its breadth, and has three terminal spines; of these spines the outer is the longest, being about two and a half times the length of the segment; the inner is small and rudimentary.

Length, according to de Guerne and Richard, 2–2.5 mm; Schacht, female, 1.7 mm, male, 1.4 mm; Herrick (1887), 2.3 mm. Those measured by the author slightly exceed the figures of Schacht.

Remarks.—The original description by Forbes was from material collected near Normal, Ill. He also found it in Iroquois County, Ill. Herrick (1882) described his *Potomoichetor fucosus* from two localities in Minnesota. Herrick (1887) notes its occurrence in Alabama. De Guerne and Richard in 1889 recorded it from Portland, Oreg. Schacht added to previous records Havana, Ill., and Wyoming. Juday (1915) found it at Puerto Barrios and Los Amates, Guatemala. Creaser (1931) found it in crayfish burrows at Van Buren, Carter County, Ark. The author has found it in collections made by Dr. E. A. Birge at Lake Charles, La., and Bertig, Ark.; by Dr. V. E. Shelford in collections made near Gary, Ind.; and by H. K. Harring in the vicinity of Washington, D. C.

This is a somewhat erratic distribution, and it seems strange that the species has not yet been found in intervening localities. It is not evident why it has not been found in other places. There are few data in regard to its annual distribution. Presumably the Illinois collections were made in the summer. Most of the author's material was collected in the fall, but one gathering was made in March. Juday's Central American collection was made in February, but winter collections in Panama have not contained this species.

Apparently, so far as present knowledge is concerned, it is in the United States practically a Mississippi Valley species, although we have the records of Oregon and Wyoming.

The foregoing description is compiled from those of preceding authors with some additions and changes resulting from a study of the author's preparations. Herrick found the antennae 24-segmented. Forbes and, after him, Schacht considered them 24-segmented. A careful study of the preparations at hand leads the author to consider them 25-segmented. The separation of the first two segments is not always easy to distinguish. Moreover, the basal segment is not jointed, and, perhaps on this account, has not been counted by some authors.

Apparently the peculiar enlargement of the seta on the second segment of the exopod of the male fourth foot with the hollow of the second segment has not been noted by others. This was found constant in all the male fourth feet examined.

Family TEMORIDAE

Genus EURYTEMORA Giesbrecht, 1881

Last thoracic segment separated from the preceding, often expanded into wings, symmetrical in male. Abdomen of female 3-segmented. Abdomen of male 5-segmented.

First antennae 24-segmented; but *E. grimmi* has 25 segments. Terminal portion of right antenna of male generally stated to be 2-segmented. Giesbrecht and Schmeil (1898) state "two, seldom more." Apparently in most cases there is a distinct short terminal segment, which would make the typical number three. Giesbrecht (1882) states that in *E. hirundo* it is 2-segmented. Sars's figure for *E. grimmi* shows five segments, while his figure for *E. gracilis* shows four. Probably it is safe to say that the terminal portion of the right antenna of the male ordinarily consists of three segments, but in some cases there are more.

The exopod of the second antenna, as in *Diaptomus*, consists of seven segments, with four short ones in the middle. The endopod of the maxilliped consists of five segments, as in *Diaptomus*, *Limnocalanus*, and *Osphranticum*. The endopod of the first foot is 1-segmented; of feet 2 to 4, 2-segmented. The penultimate segment of the fifth foot of the female has a process from its inner distal angle. The right fifth foot of the male has four or five segments.

KEY TO THE SPECIES OF EURYTEMORA (FROM CHARACTERS OF FEMALE)

- | | |
|---|--|
| 1. Third segment of fifth foot with one external spine..... | 2 |
| Third segment of fifth foot with two external spines..... | 3 |
| 2. Last cephalothoracic segment expanded, with large wings | |
| pointed backward..... | <i>velox</i> (Lilljeborg) ⁶ |
| Last cephalothoracic segment without wings, rounded behind. | <i>grimmi</i> (Sars) |

⁶ Synonyms: *E. adleri* Schikolejew and *E. lacunculata* (Fischer).

3. Process of penultimate segment of fifth foot approximately perpendicular to axis of foot----- 4
 Process of penultimate segment of fifth foot bent distally----- 12
4. Dorsal surface of furca and terminal abdominal segment armed with spines----- 5
 Dorsal surface of furca and terminal abdominal segment not armed with spines----- 11
5. First abdominal segment not definitely enlarged laterally----- 6
 First abdominal segment more or less enlarged laterally----- 7
6. Sides of last cephalothoracic segment not expanded laterally, rounded; process of penultimate segment of fifth foot of female about one-half length of ultimate segment----- *canadensis* Marsh
 Sides of last cephalothoracic segment expanded in pointed wings; process of penultimate segment of fifth foot of female nearly twice as long as ultimate segment----- *americana* Williams
7. Proximal half of first abdominal segment strongly expanded----- 8
 First abdominal segment expanded in two lobes on each side----- 10
8. Wings of last cephalothoracic segment pointed----- 9
 Wings of last cephalothoracic segment rounded----- *hirundo* (Giesbrecht)
9. Furca of female five to seven times as long as broad; antennae slightly exceeding second thoracic segment; wings of last cephalothoracic segment extending outward----- *affinis* (Poppe)⁷
 Furca of female 8 to 12 times as long as broad; antennae equaling or nearly equaling cephalothorax; slenderer and smaller than *affinis*; wings pointed or rounded, not distinctly projecting outward----- *hirundoides* (Nordquist)⁸
10. Wings of last cephalothoracic segment pointed; furca three or four times as long as broad----- *raboti* Richard
 Wings of last cephalothoracic segment blunt; furca seven times as long as broad----- *composita* Keiser
11. Sides of last cephalothoracic segment not expanded outward, *lacustris* (Poppe)
 Sides of last cephalothoracic segment markedly expanded outward----- 13
12. Wings of last cephalothoracic segment extended backward beyond first abdominal segment; process of penultimate segment of fifth foot dentate on both sides, extended distad beyond end of terminal spine of ultimate segment.
herdmani Thompson and Scott
 Wings of last cephalothoracic segment not reaching end of first abdominal segment; process of penultimate segment of fifth foot dentate on outer side, not reaching ultimate segment.
johanseni Willey
13. Wings of last cephalothoracic segment expanded out and distad; process of penultimate segment of fifth foot not dentate, *gracilis* (Sars)
 Wings of last cephalothoracic segment recurved at tip; process of penultimate segment of fifth foot dentate----- *tolli* Rylov

⁷ Synonym: *E. adleri*.

⁸ Olofsson considers *hirundo* and *hirundoides* as variations of *affinis*. Nordquist states *hirundoides* to be the connecting link between *affinis* and *hirundo*. Schmeil considers *hirundo* and *hirundoides* good species. DeLint considers *hirundoides* a good variation.

EURYTEMORA AFFINIS (Poppe)

PLATE 6, FIGURES 1-3, 8

- Temora velox* LILLJEBORG, 1853, p. 77, pl. 19, figs. 9, 10, pl. 20, fig. 1.
Temora affinis POPPE, 1880, p. 55, pl. 3.—HERRICK, 1884, p. 133, pl. H, figs. 8-16.
Temorella affinis CLAUS, 1881, p. 491, pl. 2, figs. 8-14.—HERRICK, 1887, p. 9, pl. 1, figs. 3-6, pl. 2, figs. 9-12.—CANU, 1888, p. 88, pl. 7, figs. 1-3.
Temorella affinis var. *hispida* NORDQUIST, 1888, p. 53, pl. 5, figs. 1, 6, 7, 10, pl. 6, figs. 4, 5.
Eurytemora affinis DE GUERNE and RICHARD, 1889, p. 84, figs. 46, 47.—RICHARD, 1891, p. 247, figs. 13, 14.—BRADY, 1891, p. 42, pl. 13, figs. 6-9.—HERRICK and TURNER, 1895, p. 51, pl. 1, figs. 5-10, pl. 60, figs. 8-15.—SCHMEIL, 1896, p. 114, pl. 8, fig. 11, pl. 11, figs. 1-11.—GIESBRECHT and SCHMEIL, 1898, p. 103.—FOSTER, 1904, p. 73.—MARSH, 1918, p. 756.—RYLOV, 1922, p. 45, fig. 24. *a-d*: 1930, p. 224, fig. 74, 1-4.—PESTA, 1928, p. 47, fig. 39, A, B.—WILSON, 1932,⁹ pp. 111, 112, fig. 74.
Eurytemora thompsoni WILLEY, 1923, p. 313, fig. 7.

Last cephalothoracic segment expanded into two large pointed wings extending distad and outward with nearly straight outer borders. (Pl. 6, fig. 8.) The first abdominal segment projects on the ventral side; it is expanded laterally for about one-half its length, then narrowed suddenly. (Pl. 6, figs. 1, 3.) On the ventral side are two triangular projections from the sides of the anterior part of the segment, as shown in Plate 6, Figure 3. The second segment is very short. The furcal rami are ciliate on their inner borders, and, in the female, the dorsal surfaces of the furcae and of the last abdominal segment are thickly beset with small spines. The rami, in the female, are five to seven times as long as wide; in the male (pl. 6, fig. 2) the length is much greater. The first antennae vary in length, sometimes nearly equaling the cephalothorax, but generally being from two-thirds to three-fourths its length.

The fifth foot of the female (pl. 6, fig. 8) has two spines on the external border of the first segment of the exopod; the process of the inner side of this segment is large, projecting inward and slightly distally; it is considerably longer than the second segment of the exopod.

The last two segments of the exopod of the right fifth foot of the male are united and the proximal portion is swollen. The last segment of the left fifth foot is terminated by a rounded process and a digitate projection. This is shown in Plate 6, Figure 6, of *E. hirundoides*.

The length of the species, as given by various authors, evidently refers to the female and is about 1.5 mm. Measurements of American specimens were about the same, the females measuring 1.5 mm or somewhat less, and the males 1 to 1.25 mm.

⁹References herein to Doctor Wilson's monograph on the copepods of the Woods Hole region were added during the course of editing.—EDITOR.

Occurrence.—Pope described *E. affinis* from material collected near the mouths of several German rivers. It may be found in salt, brackish, or fresh water. It occurs in France, Germany, Sweden, England, and Scotland, in the fresh-water lagoons of the Caspian Sea at the mouth of the Volga, in fresh water in central Asia, and on Kolguev Island. Herrick (1884) was the first to report it in America, finding it in the shallow bays along the Gulf of Mexico. Foster (1904) gave localities near New Orleans. Pearse (1906) recorded it from Nantucket Island and wrote me that he had seen it in 1911 at Tampico, Mexico. Marsh (1912) reported it from St. Johns River and Little Lake George, Fla., from Black Bayou, Miss., and Flat Lake, La. It has also been found in Shreveport, La. Willey (1923) found it in Lake St. John, a fresh-water lake. Its distribution is interesting, for in many cases it has been found a long distance from salt water.

EURYTEMORA GRACILIS (Sars)

Temorella gracilis Sars, 1898, p. 336, pl. 8, figs. 8-18.

Eurytemora gracilis Willey, 1920, p. 11K, fig. 3, 3 and 4.—Rylov, 1930, p. 228, fig. 75, 1-4.

E. gracilis is a slender form closely resembling *E. affinis*; it differs from this species in that the head is somewhat broader, the wings of the last cephalothoracic segment flare out laterally, and the last abdominal segment and the furca are not armed with spines.

Length: Female, 1.4 mm; male, 1.25 mm.

Occurrence.—Sars reported it in the lower part of the river Jana. Willey found a single damaged female in the collections of the Canadian Arctic expedition.

EURYTEMORA CANADENSIS Marsh

PLATE 7; PLATE 8, FIGURES 5, 6

Eurytemora canadensis Marsh, 1920, pp. 4J, 5J, pl. 1, figs. 9-12, pl. 2, figs. 1, 2, 4, 7.

Female.—Cephalothorax oval, the greatest width being forward of the middle. (Pl. 7, fig. 6.) The last cephalothoracic segment extends backward but is not produced laterally (pl. 8, fig. 5); the wings are rounded and the margins are armed with a few minute hairs. The first abdominal segment is slightly expanded laterally (pl. 7, fig. 4) and is armed on the outer edge with scattered fine hairs. The first and third abdominal segments are about equal in length and are about one and one-half times the length of the second. The furcal rami are slender, about eight times as long as wide; they are ciliate on both inner and outer borders except distad of the lateral seta, where there are one or two hairs; there are some hairs on the surface.

The antennae extend nearly or quite to the fourth cephalothoracic segment. The swimming feet are typical of the genus. Plate 8, Figure 6, shows the fourth foot. In the fifth foot (pl. 7, fig. 2) the second segment of the basipod has a seta about midway of its outer margin. The first segment of the exopod is about twice as long as broad; it has a long spine at about midway of its outer border and another at its outer distal angle; the unguiform process of the inner distal angle projects at an angle of about 45° with the axis of the segment; the distal border of this process is armed with 6 to 11 teeth. The second segment of the exopod is about one-half as long as the first and has a spine at the outer distal angle and a long terminal spine.

Length, 1.9 to 2.25 mm.

Male.—The cephalothorax is narrower than in the female, and elliptical rather than oval in outline. The abdomen (pl. 7, fig. 3) is slender, the segments being of about equal lengths. The furcal rami have about the same proportions as in the female; they are ciliate on the inner border, and very sparsely ciliate on the outer. The fifth foot is shown in Plate 7, Figure 5; the right foot is distinctly 4-segmented.

Length, 1.95 to 2.1 mm. Collected by Frits Johansen, of the Canadian Arctic expedition, at Bernard Harbor.

EURYTEMORA HERDMANI Thompson and Scott

PLATE 8, FIGURES 1-3

Eurytemora herdmanni THOMPSON and SCOTT, 1897, p. 78, pl. 5, figs. 1-11.—
GIESBRECHT and SCHMELL, 1898, p. 103.—SHARPE, 1910, p. 410, fig. 2.—
WILSON, 1932, pp. 112-114, fig. 75.

Wings of last cephalothoracic segment very largely developed, extending distad beyond the first abdominal segment. (Pl. 8, fig. 2.) The first abdominal segment is expanded in the distal half into two rounded projections extending distad. The first antennae are about as long as the cephalothorax. In the fifth foot of the female (pl. 8, fig. 1) the first segment of the exopod has two spines on the outer border. The process of the internal border is long, extending distad beyond the end of the terminal spine of the second exopod; it is armed with dentations on both inner and outer borders. The last two segments of the exopod of the right fifth foot of the male are not united. (Pl. 8, fig. 3.)

Length, 1.6 mm.

Occurrence.—This species was described from material collected in the Gulf of St. Lawrence. Williams (1906) reported it in Narragansett Bay; Sharpe (1910) and Wilson (1932) from Woods Hole,

Mass.; and Willey (1920) from several stations of the Canadian Arctic expedition. Willey (1923) also reported it from Miramichi Bay and River, Labrador, from Hudson Bay, and from contents of stomachs of shad caught in Scotsman Bay, Nova Scotia.

EURYTEMORA HIRUNDOIDES (Nordquist)

PLATE 6, FIGURES 4-7; PLATE 14, FIGURE 9

Temorella affinis var. *hirundoides* NORDQUIST, 1888, p. 48, pl. 4, figs. 5-11, pl. 5, fig. 5.

Eurytemora affinis var. *hirundoides* GIESBRECHT and SCHMEIL, 1898, p. 104.

Eurytemora hirundoides SARS, 1902, p. 102, pl. 69.—VAN BREEMEN, 1908, p. 101, fig. 117, *a-d*.—SHARPE, 1910, p. 411, fig. 3.—DE LINT, 1922, p. 81, pl. 4.—ESTERLY, 1924, p. 93, fig. F, 1-12, fig. G, 1-9.—PESTA, 1928, p. 50, fig. 41, *a-c*.—CAMPBELL, 1929, p. 315.—WILSON, 1932, pp. 110, 111, fig. 73.

A long slender species.

Female.—The wings of the last thoracic segment resemble those of *E. affinis* but extend outward less; they are pointed or rounded. The first abdominal segment (pl. 14, fig. 9), like *E. affinis*, is laterally expanded in the proximal half and is narrowly constricted at about the middle; these expansions bear on each side a small spine. The third abdominal segment is armed on the dorsal side with fine spines.

The furcal rami are ciliate on the inner margin, and on the outer margin distad of the lateral seta; the dorsal surface like that of the third segment is armed with fine spines. The length of the rami is 8 to 12 times the breadth. The first antennae are nearly as long as the cephalothorax. The fifth foot (pl. 6, fig. 5) is like that of *E. affinis*.

Male.—The male is slenderer than the female, and the last cephalothoracic segment is rounded and not expanded into lateral wings. Plate 6, Figure 4, shows the male abdomen, and Figures 6 and 7 the fifth feet of the male.

Length: Sars stated that the female reaches 1.15 mm. Nordquist's figures made the male larger than the female, obviously a mistake. According to Esterly, the female is 1.56 mm and the male 1.15 mm. DeLint (1922), who made a detailed comparison of *E. affinis* and *E. hirundoides*, considered *E. hirundoides* much the smaller form.

Occurrence.—Nordquist's description was from material collected on the coast of Finland. Sars found it abundant on the coast of Norway. Van Breemen (1908) and DeLint (1922) reported it in Holland waters. In American waters Williams (1906) reported it in Narragansett Bay; Sharpe (1910) and Wilson (1932) at Woods Hole; Willey (1923) from Labrador and Nova Scotia; Esterly (1924) from San Francisco Bay; and Campbell (1929) from Vancouver Island. The author found it in Big Timber Creek, Gloucester, N. J., on September 19. Big Timber Creek is connected

with the Delaware River and is affected by the tides. With *E. hirundooides* were found some *Cyclops* species that are common in fresh water.

Remarks.—Nordquist noted that *E. hirundooides* is a form intermediate between *E. affinis* and *E. hirundo* and that in its variations it is connected with both species. Some authors have thought both *E. hirundo* and *E. hirundooides* should be considered as varieties of *E. affinis*. Inasmuch as the names cover distinct characteristics, it has seemed best here to give them specific rank, although it is recognized that they are closely related.

While *E. affinis* is found in both fresh and salt water, *E. hirundooides* apparently does not occur in water that is entirely fresh.

EURYTEMORA JOHANSENI Willey

PLATE 8. FIGURES 4, 7

Eurytemora johanseni WILLEY, 1920, p. 13K, figs. 5-7, 9, 11-13.

The wings of the last cephalothoracic segment are produced distad but do not reach the end of the first abdominal segment. (Pl. 8, fig. 4.) The first abdominal segment is expanded about midway of its length. The second and third segments and the furcal rami are of about equal length. The first antennae about equal the cephalothorax. In the fifth feet of the female (pl. 8, fig. 7) the unguiform process of the second segment of the exopod extends distad, but is not so long as the second segment; it is dentate on the inner border.

Length: Female, 1.28 mm; male, 1.12 mm.

Occurrence.—Described from collections of the Canadian Arctic expedition.

Genus EPISCHURA Forbes, 1882

Cephalothorax more or less distinctly 6-segmented. Abdomen in the female composed of four segments, in the male of five. Abdomen of the male more or less asymmetrical and in most species bent to the right; processes forming a prehensile apparatus projecting to the right; these processes, in *E. baikalensis* and *E. chankensis*, are found clearly only on the fifth segment, in the other species on the second, third, and fifth. The furcal rami are ciliate on the inner margin and each is armed with a short outer spine, a slender inner seta, and three plumose setae of about equal length.

The first antennae (pl. 9, fig. 1) are 25-segmented, the last segment short; the right male antenna (pl. 9, fig. 2) is 22-segmented, geniculate between the eighteenth and nineteenth segments, the segments preceding the geniculation being slightly swollen.

The exopod of the second antenna is 7-segmented, with three short central segments (pl. 11, fig. 1) and a short terminal segment. The

endopod of the maxilliped is 4-segmented (pl. 9, fig. 3). All the swimming feet are biramose, the exopods having three segments and the endopods one. In all the feet the endopods bear five setae. In the first foot the first and second segments of the exopods have each two setae, one external and one internal; the terminal segments bear six setae. In the second (pl. 9, fig. 5), third, and fourth feet the first and second segments of the exopods have spines externally instead of setae as in the first foot; the terminal segments have two short spines on the external border, at the end a long spine with its outer margin deeply serrate, and four setae on the inner border.

The fifth feet of the female (pl. 10, fig. 4) are uniramous. The first basipods are confluent; the second basipods are distinct; the exopod is 2-segmented, the second segment armed at the tip and sometimes on the sides with spines, which vary in number from three to eight; there are no endopods in mature forms.

The fifth feet of the male (pl. 9, fig. 4) are uniramous and dissimilar; the first basipods are confluent. The right foot consists of the second basipod and an exopod of one segment, the exopod being strongly flexed. The left foot consists of the second basipod and an exopod of two segments; the second basipod bears a long curved process projecting from its inner border; a study of larval forms shows that this process represents an endopod; the second segment of the exopod is more or less sinuate on the inner margin and, in all except *E. chankensis*, armed with spines; in *E. chankensis* there is a tuft of cilia at the tip.

Occurrence.—With the exception of two species, *E. baikalensis* and *E. chankensis*, which are found in Asia, the genus occurs only in North America. It is not commonly found much south of latitude 40° N. in America, and it extends north to Alaska. The three American species appear to have a fairly restricted distribution—*E. lacustris* to the general region of the Great Lakes, going north to Lake Winnipeg, *E. nevadensis* to the mountains of the Pacific region, from central California to Alaska, and *E. nordenskiöldi* to the Atlantic coast from Newfoundland to North Carolina.

KEY TO THE SPECIES OF EPISCHURA

- | | |
|--|-------------------------|
| 1. Segments 2, 3, and 5 of male abdomen armed with projecting processes..... | 2 |
| Only fifth abdominal segment of male armed with projecting processes..... | 4 |
| 2. Female abdomen bent to right, and external furcal setae much broader than others..... | <i>lacustris</i> Forbes |
| Female abdomen straight or nearly so, and all furcal setae approximately same width..... | 3 |

3. Fifth abdominal segment in male with two projecting processes;
terminal segment of female fifth foot armed with six spines.
nevadensis Lilljeborg
- Fifth abdominal segment in male with one projecting process;
terminal segment of female fifth foot armed with five spines.
nordenskiöldi Lilljeborg
4. Last thoracic segment of female expanded in large rounded
lobes; terminal segment of female fifth foot ending in a short
conical point and having three spines in its external border.
baikalensis Sars
- Last thoracic segment of female with shorter wings than in
baikalensis; terminal segment of female fifth foot armed with
three terminal spines.----- *chankensis* Rylov

EPISCHURA LACUSTRIS Forbes

PLATE 9; PLATE 10, FIGURES 3-5; PLATE 11, FIGURE 1

(?) *Scopiphora vagans* PICKERING, in DeKay, 1844, p. 62.

Epischura lacustris FORBES, 1882, pp. 541, 648, pl. 8, figs. 15, 16, 21, 23, pl. 9, fig. 8; 1891, p. 704, pl. 1, figs. 1-5, pl. 2, fig. 7.—HERRICK, 1884, p. 131, pl. Q, fig. 13.—DE GUERNE and RICHARD, 1889, p. 96, pl. 4, figs. 3, 9, 10.—MARSH, 1893, p. 200, pl. 4, fig. 6; 1895, p. 10, pl. 2, figs. 1-6, pl. 3, figs. 1-6; 1918, p. 756, fig. 1175.—HERRICK and TURNER, 1895, p. 82, pl. 13, fig. 15.—SCHACHT, 1898, p. 260.—TOLLINGER, 1911, p. 154, fig. 0'.—WILSON, 1929, p. 126.

The abdomen of the female (pl. 10, fig. 5) is bent to the right. The first segment is short, the second about equal in length to the rest of the abdomen and the furca. The second segment is produced at the right in a rounded process. The spermatophore is ordinarily curved but not wound about the abdomen, as in *E. nordenskiöldi*. The furcal rami are broad. The spines at the external distal angles are stout, the right one being much broader than the left. Of the terminal setae, the outside ones are much broader than the others.

The 5-segmented abdomen of the male (pl. 10, fig. 3) is strongly bent to the right with processes projecting to the right from the second, third, and fifth segments. The process of the second segment is triangular, about as long as the segment is wide, with a rounded recurved tip; the distal border is sinuate and indistinctly toothed. The process of the third segment is similar in form and size to that of the second; it is armed at the tip with a rugose pad on both proximal and distal margins. From the right dorsal surface of the fifth segment there extends forward a smooth, spatulate process; from the ventral surface there extends to the right another similar process, which terminates in five to seven rather large teeth; its distal margin back from the tip is finely denticulate, the denticulations extending back to the furca; the spines of the furcal rami are not so prominent as in the female, and the furcal setae are of about equal width.

The antennae in the female (pl. 9, fig. 1) extend about to the fourth abdominal segment. The fifth feet of the female (pl. 10, fig. 4) are uniramous and 3-segmented, the first segment being the second basipod and the other two the exopod. The first segment is about as broad as long and bears a small spine at the outer distal angle. The segments of the exopod are elongate and narrower than the first. The second is about $1\frac{1}{2}$ times the length of the first. The first segment of the exopod has a spine at the outer distal angle. The terminal segment has 6 spines, 4 terminals and 1 on each side; 3 of the terminal spines are spinulose. In Plate 9, Figure 3, is shown the endopod of the maxilliped, and in Figure 5 the second swimming foot.

The right fifth foot of the male (pl. 9, fig. 4) is 2-segmented, consisting of the second basipod and a 1-segmented exopod, broad at the proximal end and diminishing to a blunt-pointed tip at the distal end; it is flexed upon the second basipod. The second basipod of the left fifth foot has a seta at three-fourths the length of the outer border; the second segment of the exopod has a broad base and terminates in a spine; its inner border is concave and armed with long hairs and it has on the outer border one to three spines.

Occurrence.—*E. lacustris* is found abundantly, especially in deep cool waters, in Illinois, Indiana, Ohio, Minnesota, Wisconsin, Michigan, and New York. It has been reported from Maine by Bishop and Clarke, and I have seen specimens collected in Lake Sebago by Doolittle. Willey (1920) reported it in Nova Scotia, Bigelow (1923) in Lake Nipigon, and Bajkov (1930) in Winnipeg, Winnipegosis, and Atikameg. De Guerne and Richard (1889) stated that it was found by Lilljeborg in a collection from East Portland, Oreg., and Schacht (1898) repeats this location: it seems probable that this identification was wrong and that Lilljeborg really had *E. nevadensis*, as there is no other report of *E. lacustris* in the Pacific coast region.

EPISCHURA NEVADENSIS Lilljeborg

PLATE 11, FIGURES 2-7: PLATE 12, FIGURE 1

- Epischura nevadensis* LILLJEBORG, in de Guerne and Richard, 1889, p. 93, pl. 2, figs. 17, 24, pl. 3, fig. 21.—HERRICK and TURNER, 1895, p. 84, pl. 11, figs. 1, 6, 8.—GIESBRECHT and SCHMELL, 1898, p. 183.—SCHACHT, 1898, p. 256.—TOLLINGER, 1911, pp. 153, 154, fig. N¹.—MARSH, 1918, p. 756, fig. 1174.
- Epischura nevadensis* var. *columbiae* FORBES, 1893, p. 254, pl. 41, figs. 19-21.—HERRICK and TURNER, 1895, p. 84, p. 11, figs. 4, 10.

The abdomen of the female (pl. 11, fig. 2) is straight or nearly so; the first and second and the third and fourth segments are ordinarily more or less confluent, so that the abdomen may appear to consist of less than four segments. The spermatophores are straight or slightly bent.

The spines at the external distal angles of the furca are not so broad as in *E. lacustris*, and the terminal setae are of equal width. The interior margins of the furca are finely ciliate.

The abdomen of the male (pl. 11, fig. 3) is strongly bent to the right. From the second abdominal segment a process extends to the right and is nearly as long as the width of the segment; it is recurved at the tip and both proximal and distal margins are sinuate and the distal margin is armed with irregular teeth. The process of the third segment extends to the right from the distal half of the segment, is of about the same width through its length, and is rounded at the end. There are two processes on the right of the fifth segment, one a rounded hyaline plate, somewhat spatula-shaped, and projecting forward from the dorsal surface to about the middle of the third segment, and the other (pl. 11, fig. 7) a somewhat triangular projection from the ventral surface to the right; this latter process bears five or six teeth, and extending down the dextral margin of the process are minute serrations, which, near the junction of the segment with the furca, are replaced by distinct teeth (pl. 11, fig. 7).

The first antennae of the female, according to Schacht, extend slightly beyond the third abdominal segment; according to Lilljeborg they do not reach the base of the furca. In the author's material the length is somewhat variable and in many cases exceeds that of the furca.

In the fifth foot of the female (pl. 11, fig. 4) the second basipod is longer than wide, the first and second segments of the exopod are of about equal length and not much narrower than the second basipod. The second basipod is armed on the outer border at about two-thirds or three-fourths of its length with a small spine or seta. The first segment of the exopod has, at its outer distal angle, a small spine. The second segment has six spines, one on each side and four terminal, the terminal being the larger. Forbes stated that a seventh spine is sometimes present on the third segment. Though six is the normal number, there is doubtless some variation in both number and position. Seven have been found in specimens from Alaska; in one preparation (pl. 11, fig. 5) eight were found, and in this the positions of the spines were different in the two feet.

The right fifth foot of the male (pl. 11, fig. 6) is 2-segmented. The first segment, which is really the second basipod, is more than twice as long as broad, wider at the distal end, and bears upon the inner distal margin a denticulate hyaline lamella. It has a delicate seta on the external margin at about two-thirds its length. The left foot does not differ from that in *E. lacustris*.

Length: According to Lilljeborg: Female, about 2 mm, male, about 1.7 mm; according to Schacht: Female, 2 mm to 2.5 mm, male, 1.7 mm to 2.1 mm. The author has made a number of measurements; of these the largest average was in collections from Hope, Idaho; the females measured 2.02 mm, the males 1.76 mm. In Tsiltcoos Lake, Oreg., the females averaged 1.32 mm and the males 1.27 mm.

Occurrence.—The original description was from material collected in Echo Lake and Lake Tahoe in California. Forbes found it in Swan Lake and Flathead Lake, Mont. Schacht also reported it from Gambles Lake and Lake Pend Oreille, Idaho; Lake Tahkenitch and Tsiltcoos Lake, Oreg.; and Lake Union and Lake Washington, Wash. Kemmerer, Bovard, and Boorman (1924) found it in many lakes in Washington and in Bear Lake, Idaho. It was found in collections made by E. M. Ball on Afognak Island, Alaska. T. L. Thacker has sent material from Lake Schkam and Kawakawa Lake, British Columbia, in which this species was found. The author found it in material collected by Dr. H. B. Ward, from a number of small lakes near Lake Tahoe, and has collected it in Stanislaus National Forest, Calif., and in Lake Chelan, Wash. An immature *Epischura* was found in Lake Helen on Mount Lassen, Calif., and in a pond at an elevation of 1,000 feet near Baldwin, Colo. It was impossible to identify this material but it probably would be this species. It will be seen that the distribution is pretty well limited to the Pacific region, the most eastern point being Bear Lake, Idaho, if we disregard the possible location in Colorado. It has not been found much south of the Lake Tahoe region but extends north into Alaska.

Remarks.—The original description by Lilljeborg is correct, but his figure of the male abdomen is misleading; from a certain angle it is correct as shown by the similar drawing from the ventral side. (Pl. 12, fig. 1.) Plate 11, Figure 3, however, gives a more accurate idea of its form. The figure by Forbes (1893) was in the main correct. Schacht stated that the appendage near the outer distal angle of the first segment of the female fifth foot is "correctly drawn by Lilljeborg as a seta, while Forbes's figure represents it as spine-like." This appendage seems to vary, sometimes being a seta and sometimes a spine. In material from Lake Tahoe it was a spine.

EPISCHURA NORDENSKIÖLDI Lilljeborg

PLATE 12, FIGURES 2-6

- Epischura nordenskiöldi* LILLJEBORG, in de Guerne and Richard, 1889, p. 146, pl. 1, fig. 36, pl. 2, figs. 15, 23.—HERRICK and TURNER, 1895, p. 85, pl. 11, figs. 2, 5, 9.—GIESBRECHT and SCHMEL, 1898, p. 183.—SCHACHT, 1898, p. 252.—TOLLINGER, 1911, p. 153, fig. N⁴.—KIEFER, 1931, p. 583, figs. 1, 2.
Epischura nevadensis WILSON, 1932, pp. 115-117, fig. 77.

The abdomen of the female (pl. 12, fig. 3) is not bent. Of the four segments, the first two are frequently imperfectly separated. The furcal rami are about twice as long as broad and ciliate on the inner border. The spermatophore is bent around the abdomen, as shown in Plate 12, Figure 3.

The second, third, and fifth segments of the male abdomen (pl. 12, fig. 4) are armed with projecting processes. The process of the second segment is triangular, about one-half as long as the width of the segment, and rather strongly concave on the distal border. The process of the third segment is short and blunt and projects from the dextral distal angle of the segment. The process of the fifth segment is a small blunt pointed triangular hyaline plate on the right side projecting forward. A beadlike row of serrulations extends down the right side of the segment.

The female antennae are stated by Lilljeborg and by Schacht to reach the base of the furca; in the Massachusetts specimens they reached the end of the furca. In the fifth feet of the female (pl. 12, fig. 5) the second basipod is about as long as its width and bears near the outer distal angle a small spine or seta. The second basipod and the two segments of the exopod are of about equal length. The first segment of the exopod has a small spine at its outer distal angle. The second segment has five terminal spines, or they may be considered as three terminal and two lateral, one on each side.

The male fifth foot (pl. 12, fig. 6) is much like that in *E. lacustris* and *E. nevadensis*; there is a distinct difference, however, in the second segment of the exopod of the left foot; this is slightly curved, approximately of the same width throughout its length, blunt pointed, armed with four spines on its external border, and ciliate on the distal portion of the inner border. In some individuals the inner border of this segment is sinuate, in others it is an unbroken curve like the figure. Lilljeborg states that the second basipod of the left fifth foot bears a large hook on its inner border and shows this hook in his figure. Schacht (1898) also mentions this hook. The hook was not found in any of the Massachusetts material, and Schmeil (1898) stated that an examination of the original material of Lilljeborg failed to show its presence. Schacht's statement that he found the spine is evidently due to a misunderstanding. Schmeil wrote of the "thorn" on the *second basipod of the right foot*. This would be the segment commonly spoken of as the first, which Schacht refers to the *second*, or first segment of the exopod.

Length: According to Lilljeborg: Female, 2.9 mm, male, 1.1 mm; according to Schacht: Female, 1.9 mm, male, 1.1 mm. The Massachu-

setts specimens averaged: Female, 1.64 mm; male, 1.58 mm. It seems probable that Lilljeborg's figure for the female is a misprint for 1.9 mm.

Occurrence.—The original description was from collections made at St. Johns in Newfoundland. Schacht's description was from Lilljeborg's material. Willey (1923) reported it from the Shubenacadie River, Nova Scotia, but gave no description. Wilson collected it in eastern Massachusetts but determined it as *E. nevadensis*. An examination of his material deposited in the United States National Museum shows that it is *E. nordenskiöldi*. It seems probable that it will appear in other localities in New England. It was found in a collection made by Dr. R. E. Coker in White Lake, N. C.; this locality is especially interesting as it indicates a possible wide distribution of the species.

EPISCHURA BAIKALENSIS Sars

PLATE 13. FIGURES 1-4

Epischura baikalensis Sars, 1900, p. 226, pl. 6, figs. 1-17.—TOLLINGER, 1911, p. 157, fig. P'.—RYLOV, 1930, p. 258, fig. 84, 1 and 2; fig. 85, 1 and 2.

Female cephalic segment well defined, having dorsally a strongly marked cervical depression. Last cephalothoracic segment expanded on the sides in rather large rounded lobes. Abdomen (pl. 13, fig. 1) of three evident segments. The spermatophore is twisted and accompanied by a hyaline curved plate. The terminal setae of the furca in adult females are very short and curved.

The abdomen of the male (pl. 13, fig. 2) is asymmetrical, and the apical setae are of normal length. The abdomen is slightly bent to the right. The segments are of about equal length and more prominent on the right side. Only the last segment has a distinct process; this is a recurved lobule placed somewhat ventrally and projecting to the right.

The first antennae reach to about the end of the furca. The exopod of the second antenna is said by Sars to have five segments; his figure, however, more or less clearly shows six. Evidently Sars did not recognize the small terminal segment, which is characteristic of other species.

In the fifth feet of the female (pl. 13, fig. 3) the second basipod is short, about as broad as long, and armed with a small spinule on the external border. The first segment of the exopod has a spine at the outer distal angle. The second segment terminates in a short conical point and has three spines on its external border.

The right fifth foot of the male (pl. 13, fig. 4) is 2-segmented. The second basipod has a blunt projection from its inner border, probably representing an endopod; the exopod is a slender curved

hook. The second basipod of the left foot has the long curved projection of the genus, but it is longer and slenderer than in the other species. The first segment of the exopod is longer and narrower than the second basipod. The second segment of the exopod has a broad rounded end armed with two small spines.

Length: Female, 1.5 mm; male, 1.2 mm.

Found in Lake Baikal, Asia.

The preceding description is from the original account by Sars.

EPISCHURA CHANKENSIS Rylov

PLATE 10, FIGURES 1, 2

Epischura chankensis RYLOV, 1928, p. 126, figs. 1-12; 1930, p. 260, fig. 86, 1-3; fig. 87, 1 and 2; fig. 88, 1-4.

E. chankensis resembles *E. baikalensis* very closely but differs in the following particulars:

In the female the lateral wings of the last cephalothoracic segment are shorter and do not so distinctly project backward. The branches of the furca are asymmetric. The hyaline abdominal plate is larger than in *E. baikalensis*. The last segment of the exopod of the fifth foot (pl. 10, fig. 2) is shorter than in *E. baikalensis* and is armed with three rather stout spines, which are practically terminal.

In the right fifth foot of the male (pl. 10, fig. 1) the internal process of the second basipod is much longer than in *E. baikalensis*, and the hook of the terminal segment is irregularly curved. The terminal segment of the left foot is shorter than in *E. baikalensis* and armed at the end with a bunch of cilia.

Occurrence.—This species was found in Lake Chanka, about 200 kilometers north of Vladivostok.

DOUBTFUL SPECIES

EPISCHURA FLUVIATILIS Herrick, 1883

This species was reported by Herrick and has not been seen since. If his figures are correct, it is not an *Epischura*, and the suggestion of a new genus, *Lamellipodia*, by Schmeil is justified. As there are inconsistencies in Herrick's description, however, and as the form has been found by no one else, it seems better to consider this a doubtful species. Schacht has given a very full discussion of the subject, and it does not seem necessary to repeat it here.

EPISCHURA MASSACHUSETTENSIS Pearse, 1906

It is impossible to decide whether this is a new species or an imperfect description of one of those already recognized. Only females were found and the figures were of the abdomen and fifth foot. The

furca is armed with an external seta instead of a spine as in the American species of *Epischura*. The fifth foot has seven spines instead of five or six as in typical species. From the locality of Pearse's collection it would seem probable that he had *E. nordenskiöldi*, but the structure of the fifth foot would seem to negative this opinion.

Genus HETEROCOPE Sars, 1863

Heterocope closely resembles *Epischura*. While the form and segmentation of the cephalothorax are like *Epischura*, the abdomen of the female is 3-segmented and that of the male 5-segmented; the abdomen is not flexed in either sex. The furca, as in *Epischura*, is armed with three setae, but the external spine of *Epischura* is either lacking entirely or replaced by a short seta. The first and second antennae, mandibles, maxillae, and maxillipeds are like those in *Epischura*. The segmentation of the swimming feet is like that in *Epischura*, but in some species the armature of spines is developed asymmetrically.

In the fifth foot of the female the terminal segment is armed with two spines externally, with four hooklike teeth internally, and a long terminal claw. *Heterocope caspia* has only three internal spines and the terminal claw is simply a longer spine.

The right fifth foot of the male has a 2-segmented exopod (one in *H. caspia* and *H. appendiculata*), which is not reflexed as in *Epischura*. The terminal segment of the left foot has two lateral spines on the external border and two terminal spines, one of which is ordinarily elongated.

As material was not available for a critical study of any of the species of Europe and Asia, it did not seem wise, in this publication, to make a detailed analysis of the species. Only one species has been found in America and that is clearly distinct from those of the eastern continents.

H. caspia is very different from the other species, and it is possible that this should be considered as generically distinct. On this account it has seemed best to add a brief description of this species.

KEY TO THE SPECIES OF HETEROCOPE

1. Terminal segment of female fifth foot armed with six nearly equal spines----- *caspia* Sars
 Terminal segment of female fifth foot armed with six spines, four internal and two external, and an elongated terminal hook----- 2
2. Exopod of male right fifth foot united with second segment of basipod in a long curved single segment----- *appendiculata* Sars
 Exopod of male right fifth foot composed of one or two segments----- 3

3. Exopod of male right fifth foot composed of one segment— *soldatovi* Rylov
 Exopod of male right fifth foot composed of two segments----- 4
4. In female no processes on sides of genital opening; in male armature of swimming feet symmetrical----- *saliens* Lilljeborg¹⁹
 In female processes on sides of genital opening; in male armature of some of swimming feet symmetrical----- 5
5. In female a dentiform projection on each side of genital area; in male exopods of swimming feet 2 to 4 modified----- *borealis* Fischer¹⁴
 In female trilobate processes on each side of genital opening; in male first, third, and fourth swimming feet symmetrical, exopod of right second foot much modified.
septentrionalis Juday and Muttkowski

HETEROCOPE SEPTENTRIONALIS Juday and Muttkowski

PLATE 14, FIGURES 1-8

Heterocope septentrionalis JUDAY and MUTTKOWSKI, 1915, pp. 27-31, figs. 4-6.—
 MARSH, 1920, pp. 5, 6, pl. 2, figs. 3, 5, 6, 8-13.—RYLOV, 1924, pp. 225-232.

The abdomen of the female (pl. 14, fig. 3) consists of three segments, the first being nearly equal to the combined length of the second and third; the second and third are of about the same length. The genital area bears two trilobate processes (pl. 14, figs. 5-7). Though these are typically trilobate, there is much variability in their form and sometimes they may be bilobate, as in Figure 7. The length of the furcal rami is about $1\frac{1}{2}$ times the breadth. They are ciliate on the inner border, and in addition to the three setae, typical of the genus, bear at the inner and outer distal angles short and slender setae.

The first antennae may slightly exceed the first abdominal segment. The second antennae are like those typical of *Heterocope*, the exopod consisting of seven segments, three short central and one short terminal.

The swimming feet are symmetrical. The fifth foot of the female (pl. 14, fig. 8) is like those typical of the genus. The second basipod and the first exopod are armed with spines at the outer distal angles. The second exopod bears two spines externally, a terminal claw which exceeds in length the segment, and in the inner border four hooklike teeth; these teeth are each armed with one to three denticles. There is a minute spine between the distal external spine and the terminal claw.

In the male the first, third, and fourth swimming feet are symmetrical. The right exopod of the second foot is quite different from the left (pl. 14, fig. 2); the spine of the first segment (pl. 14, fig. 4) is much enlarged and armed with denticles, which are more irregu-

¹⁹ Synonyms: *H. romana* Imhof, *H. robusta* Sars, *H. alpina* Sars.

¹⁴ Synonyms: *H. robusta* Grube, *H. saliens* Nordquist, *H. weismanni* Imhof.

larly arranged than in the corresponding spines of the left side. The external spines of the second and third segments are elongated, more or less sigmoid in form, and not armed with serrations or denticulations.

In the fifth foot of the male (pl. 14, fig. 1) the second basipod of the right foot bears a small spine near the external distal angle; the exopod consists of two segments, the distal being rounded at the tip. In the left fifth foot the process of the second basipod is long and slender, gradually tapering toward the distal end.

Average length of female, 4 mm; of male, 3.85 mm.

Occurrence.—This species was first described from material collected on St. Paul Island, Alaska. It has been found also in collections made by Dr. Frits Johansen on Herschel Island off the coast of Yukon and in collections in tundra lakes made in the same general neighborhood by J. M. Jessup.

HETEROCOPE CASPIA Sars

Heterocope caspia Sars, 1897, pp. 50–55, pl. 5, figs. 1–15.—BREHM, 1911, p. 487.—FADEEW, 1926, p. 9, figs. 10–12.—RYLOV, 1930, pp. 254–256, fig. 83. 1–7.

In the female fifth foot the first basipods are not confluent, and the last segment of the exopod does not bear a long spine, but resembles the corresponding segment of the female fifth foot of *Epischura*.

The exopod of the right fifth foot of the male is 1-segmented and has a lobular external border. On the distal end of the terminal segment of the left exopod are three small spines. The process of the second basipod of the left foot is somewhat spatulate in form.

The exopod of the second antenna has seven segments, the first, third, fourth, fifth, and sixth being short; this segmentation is like that of *Diaptomus* rather than of typical *Heterocope*.

Length: Female, less than 2 mm; male, 1.5 mm.

H. caspia differs quite materially from typical *Heterocope*.

Occurrence.—Found in the basin of the Caspian Sea in both fresh and salt water. It is considered by some to belong to the *fauna relicta*.

Family PSEUDODIAPTOMIDAE

Genus PSEUDODIAPTOMUS Herrick, 1884

Pseudodiaptomus HERRICK, 1884, pp. 180, 181.

Heterocalanus T. SCOTT, 1893, pp. 39–41.

Weismanella DAHL, 1894, pp. 10, 11.

No available synopsis of the species commonly assigned to the genus *Pseudodiaptomus* has been made since 1898, when Giesbrecht and Schmeil published "Copepoda, Gymnoplea" in *Das Tierreich*. At that time there were nine recognized species. Now there are 24.

An attempt has been made herein to provide a synopsis that would make it possible to separate the species without necessarily referring to the original descriptions.

The treatment of *Pseudodiaptomus* in the present paper must be recognized as a preliminary study. Much of the published material is very imperfect and possibly contains many mistakes. Thirteen of the species have been described only once. *Pseudodiaptomus pelagicus* Herrick, which is the type of the genus and was described in 1884, has not been seen since that time; inasmuch as Herrick's figures were poor and his description brief, it leaves a little doubt as to the generic characteristics, to say nothing of the specific distinctions.

Unfortunately, the writer has had material of only part of the species. It is very desirable that the genus should be monographed after a thorough study of material of all the species. As this is not likely to be done for a long time, this preliminary synopsis may be of value.

Description.—Last two thoracic segments coalescent. The female abdomen is composed of three or four segments; in most cases of four. The first antennae are composed of 20 to 22 segments; the terminal portion of the right antenna of the male is composed of two segments, three in *P. hickmani*.

The exopod of the second antenna is composed, according to various authors, of two to seven segments. Herrick, in his original figure, shows three. Most authors state four. The structure is seen in Plate 15, Figure 5; Plate 16, Figure 4; Plate 17, Figure 3; and Plate 18, Figure 3; the first segment is short, the second long, followed by two or more imperfectly separated segments and then a segment about equal in length to the second. It is these short central segments that have caused the differences of opinion. Herrick does not recognize them at all. Cleve figures four in *aurivilli*, making a total of seven. Apparently in *coronatus* there may be distinguished more or less clearly three segments. The first four swimming feet are biramous, each ramus consisting of three segments.

The fifth feet of the female have no endopods; in *P. hessei* and *P. stuhlmanni* there are swellings of the inner margin of the second segment of the basipod which, perhaps, are indications of a rudimentary endopod. The exopod consists of two segments; Giesbrecht and Schmeil (1898) give "two or three segments." There is, in some species, an apparent separation of a third segment, but a study of the genus indicates that this is a modification of the form of the terminal hook. The typical armature of the terminal segment is a hook with a spine branching from its base and an inner and outer spine. These spines vary in length and form.

In the right fifth foot of the male the endopod may be rudimentary or lacking; the exopod has two or three segments with a terminal hook. In the left foot the endopod may be present or lacking; the exopod is 2- or 3-segmented.

Some of the species are reported as having two egg sacs and some as having only one. It is known that in *P. coronatus*, *culebrensis*, and *richardi*, although there are two sacs, only the left is fully developed, the right one being aborted. It seems probable that in the species reported with one sac this may be considered as the left, and possibly a more careful study may show indications of the right one.

Occurrence.—The genus *Pseudodiaptomus* has not been reported from European waters. Seven species occur in America, all but one, *P. culebrensis*, from waters connected with the Atlantic. Three are in South America in the Amazon or La Plata. Two are found in North America, *P. coronatus* on the New England coast and in Chesapeake Bay, and *P. pelagicus* in Mississippi Sound. *P. pelagicus*, which was described as the type of the genus by Herrick in 1884, has never been collected by anyone else. Two species were found in the Canal Zone. Species of *Pseudodiaptomus* have been found on both coasts of Africa, in the Red Sea, the Indian Ocean, Burma, and the East Indies.

KEY TO THE SPECIES OF PSEUDODIAPTOMUS

- | | |
|---|-------------------------------|
| 1. No endopods on male fifth foot..... | 2 |
| Endopods on both male fifth feet..... | 3 |
| Endopods on right male fifth foot only..... | aurivilli Cleve ¹² |
| Endopods on left male fifth foot only..... | 6 |
| 2. Last thoracic segment of female rounded; a long falciform hook
terminating second segment of exopod of fifth foot, nearly as
long as exopod..... | gracilis (Dahl) |
| Last thoracic segment of female with pointed wings; second
segment of exopod of fifth foot terminated by two broad,
nearly equal spines, which are about one-half as long as
exopod..... | clevei A. Scott |
| 3. Last thoracic segment in female rounded..... | hessei (Mrázek) |
| Last thoracic segment in female with pointed wings..... | 4 |
| 4. Right endopod of male fifth foot not bifid..... | stuhlmanni (Pope and Mrázek) |
| Right endopod of male fifth foot bifid..... | 5 |
| 5. Terminal hook of female fifth foot and inner spine equal in
length; second segment of left exopod of male fifth foot trun-
cated at distal end..... | hickmani Sewell |
| Terminal hook of female fifth foot longer than inner spine;
second segment of exopod of male fifth foot pointed at distal
end..... | salinus (Giesbrecht) |
| 6. Left exopod of male fifth foot 1-segmented..... | acutus (Dahl) |
| Left exopod of male fifth foot 2-segmented..... | 7 |

¹² Synonym: *P. mertoni* Früchtl.

7. Terminal segment of left exopod of male fifth foot truncated----- 8
 Terminal segment of left exopod of male fifth foot either
 rounded or armed with a number of spines----- 9
8. Terminal segment of left exopod of male fifth foot dentate at
 distal margin and having an acute spine at inner distal angle.
richardi (Dahl)
- Terminal segment of left leg exopod of male fifth foot setose on
 distal margin and armed with a short, stout spine at inner
 distal angle----- cristobalensis Marsh
9. Terminal segment of left exopod of male fifth foot rounded at
 distal end----- culebrensis Marsh
- Terminal segment of left exopod of male fifth foot armed
 with spines----- 10
10. Left endopod nearly as long as exopod; abdomen of female
 4-segmented----- coronatus Williams
- Left endopod only slightly longer than first segment of exopod;
 abdomen of female 3-segmented----- pelagicus Herrick

PSEUDODIAPTOMUS ACUTUS (Dahl)

PLATE 15, FIGURES 1, 2, 4

Weismanella acuta DAHL, 1894, pp. 10, 11, pl. 1, figs. 9-11.

Pseudodiaptomus acutus GIESBRECHT and SCHMEL, 1898, p. 64.

Female.—The head is not distinctly separated from the thorax. The last two thoracic segments are armed, on the posterior border, with small spines, and the wings of the last segment are pointed. (Pl. 15, fig. 1.) There are spines on the posterior borders of the first three abdominal segments. The abdomen has four segments. The first antennae have 21 segments and extend to the second abdominal segment. In the fifth feet (pl. 15, fig. 4) the terminal hook is about twice as long as the third segment of the exopod. The inner spine of the second segment of the exopod is broad and ciliate.

Length, 1.3 mm.

Male.—In the fifth feet (pl. 15, fig. 2) there is a small endopod on the left foot. The terminal segment of the left foot is short and dentate on its distal border. The second segment of the basipod of the right foot has hairs along its inner border. The first segment of the exopod of the right foot has a linguiform appendage on its inner distal border.

Length, 1 mm.

Occurrence.—Found in the mouth of the Amazon in brackish water.

PSEUDODIAPTOMUS AURIVILLI Cleve

PLATE 15, FIGURES 3, 5-7

Pseudodiaptomus aurivilli CLEVE, 1901, pp. 48-50, pl. 6, figs. 11-22.—THOMPSON and SCOTT, 1903, p. 248, pl. 2, figs. 24-26.—A. SCOTT, 1909, p. 116.—SEWELL, 1912, p. 363.

Pseudodiaptomus mertoni FRÜCHTL, 1923, p. 455, figs. 23, 24.

Female.—Head and thorax united. Rostrum bifid, with long filaments. The last thoracic segment terminates in lateral spines. (Pl. 15, fig. 3.) The abdomen consists of four segments; there are spines on the distal margins of the first three segments. The furcal rami are seven or eight times as long as broad. The first antennae consist of 20 segments and extend to the second abdominal segment. The exopod of the second antenna is 7-segmented. (Pl. 15, fig. 5.) In the fifth foot (pl. 15, fig. 7) the first segment of the exopod is elongated. The second segment of the exopod, according to Cleve, terminates in three plumose setae, the central being about twice as long as the inner; Thompson and Scott figure one elongated seta and three spines.

Length, 1.2 mm.

Male.—The right fifth foot (pl. 15, fig. 6) has a short endopod armed with three spines. From the first segment of the right basipod, the second basipod, and the first exopod there are elongated linguiform projections; the one from the first segment of the exopod exceeds in length the second segment. The terminal hook is rather short and falciform. The left fifth foot has no endopod. The first segment of the exopod has a long, slender spine at its outer distal angle. The second segment is oval in outline and has a lateral spine at about one-third of its length.

Occurrence.—Found in Malay Archipelago, Indian Ocean, Dutch East Indies, and Bay of Bengal under marine conditions.

PSEUDODIAPTOMUS CLEVEI A. Scott

PLATE 16, FIGURES 1, 2

Pseudodiaptomus clevei A. SCOTT, 1909, pp. 116, 117, pl. 37, figs. 1-8.

Female.—The wings of the last thoracic segment are pointed; there are two dorsal spines in the surface of this segment. The abdomen has four segments; there are spines on the distal margins of the first, second, and third segments. The first antennae have 21 segments and extend to the fourth abdominal segment. In the fifth foot (pl. 16, fig. 1) there are two spines at the inner distal angle of the second segment of the basipod. The second segment of the exopod has an acute spine at the outer distal angle, a terminal spine or hook which has a broad spine near its base, and a broad inner spine which is nearly as long as the terminal central spine.

Length, 1.75 mm.

Male.—The fifth foot (pl. 16, fig. 2) has no endopods. The lateral spine of the second segment of the exopod of the right foot is long and slender, reaching the end of the terminal hook. The second segment of the exopod of the left foot is oval in outline, the end

being flattened and has a spine on the outer margin and two smaller ones on the end.

Length, 1.52 mm.

Occurrence.—Found in Dutch East Indies at Kangeang and Aru Islands in salt water.

PSEUDODIAPTOMUS CORONATUS Williams

PLATE 16, FIGURES 3-6

Pseudodiaptomus coronatus WILLIAMS, 1906, pp. 641-644, figs. 1-7.—WILSON, 1932, pp. 101-103, fig. 68.

Female.—The last thoracic segment is rounded. The abdomen (pl. 16, fig. 3) consists of four segments, the second and third ordinarily imperfectly separated. The first abdominal segment has rows of small spines on the dorsal surface at about one-half its length and spines on the distal margin; it is enlarged in front and has a pair of linguiform flaps over the genital aperture. The length of the furcal rami is about eight times their width; they are ciliate on both inner and outer margins. There are two egg sacs, but the right is aborted, containing commonly only two ova; sometimes the right is entirely lacking. The first antennae are composed of 22 segments and about equal in length the cephalothorax. The exopod of the second antennae is apparently 6-segmented. (Pl. 16, fig. 4.) In the fifth foot (pl. 16, fig. 5) the distal margins of the second segment of the basipod and the first segment of the exopod are armed with small spines. There is a spine at the exterior distal angle of the first segment of the exopod. The second segment of the exopod terminates in a rather long curved hook; there is a spine at the outer distal angle and, near the inner angle, a broad plumose spine. A small spine is attached to the base of the hook. The first segment of the exopod is more than twice as long as the second.

Length, 1.5 mm.

Male.—There is an endopod (pl. 16, fig. 6) on the left fifth foot. The first segment of the basipod of the right foot is extended on the inner distal angle into a stout spine reaching about one-half the length of the second segment of the basipod; its inner border has a short spine. The first segment of the right exopod has a stout blunt spine projecting from its dorsal surface; this spine is three-fourths as long as the segment. The inner border of the segment has short spines like those on the second segment of the basipod and near the proximal end a flask-shaped spine; this spine seems to be constant in the species. Dahl figures a similar spine in *P. richardi*. The second segment of the exopod has an acute external spine at about three-fourths of its length. The terminal hook is nearly

as long as the two segments of the exopod; on its inner border, near the base, is an acute spine. The first segment of the basipod of the left foot has four slender acute spines on its inner border. The second segment of the basipod has short spines along its inner border. The first segment of the exopod is short, with an acute spine at its outer distal border. The second segment of the exopod is about twice the length of the first, and is pointed at the end where there are three acute spines.

Length, 1.2 mm.

Occurrence.—It has been found in Narragansett Bay, Charlestown Pond at Woods Hole, and in Chesapeake Bay. Willey has reported it in Miramichi Estuary and Minas Basin. It occurs in salt and brackish water.

PSEUDODIAPTOMUS CRISTOBALENSIS Marsh

PLATE 16, FIGURE 7; PLATE 17, FIGURES 1-3

Pseudodiaptomus cristobalensis MARSH, 1913, pp. 6-8, pl. 2, figs. 1-3.

The female of this species is unknown.

The head and the first thoracic segment are coalescent. The last thoracic segment is terminated on each side with a somewhat prominent spine (pl. 17, fig. 1). The first three abdominal segments (pl. 17, fig. 2) have spines on the distal borders. The first antennae are composed of 22 segments and about equal in length the cephalothorax. The exopods of the second antennae (pl. 17, fig. 3) show clearly only two segments in the central portion. In the fifth feet (pl. 16, fig. 7) the right foot has no endopod. The hook of the right exopod is stout and about equal in length to the second segment. The left foot has a spatulate endopod, which is about twice as long as the first segment of the exopod. The second segment of the exopod is truncate at its distal end, which is armed with minute setae, has a spine about midway of the outer margin, and a minute spine opposite on the inner margin. There is a stout spine on the inner margin at about three-fourths its length and another at the inner distal angle.

Length, 0.1 mm.

Occurrence.—Found in the old French canal on the Atlantic side of the Isthmus of Panama.

PSEUDODIAPTOMUS CULEBRENSIS Marsh

PLATE 17, FIGURES 4-6; PLATE 18, FIGURES 1-3

Pseudodiaptomus culebrensis MARSH, 1913, pp. 4-6, pl. 1, figs. 1-7.

Female.—The head (pl. 18, fig. 1) is broadly rounded; the dorsal surface of the last two segments of the thorax is armed with hairs.

The angles of the last thoracic segment are rounded and hairy. The abdomen (pl. 17, fig. 6) is 3-segmented; the first segment is not expanded laterally. There are hairs on the left lateral margin of the third segment. The furcal rami are asymmetric, about seven times as long as wide and ciliate on the inner margins. The antennae are 22-segmented and exceed the cephalothorax. The segmentation of the exopod of the second antenna was indistinct in the material examined. In Plate 18, Figure 3, two central segments are shown. In others only one can be distinguished. In the fifth feet (pl. 17, fig. 5) the distal margin of the second segment of the basipod has a row of spines, and at about one-third of the length of the segment is a small lateral hair. The first segment of the exopod is about three times the length of the second. Both segments of the exopod have slender acute spines at the outer distal angles. The second segment has also two spines at the inner distal angle, one short, the other longer and ciliated. The terminal hook is slender and acute with a short blunt spine on the inner margin of the base.

In all specimens examined the right egg sac was atrophied; the left contained about eight ova.

Length, 1.22 mm.

Male.—The abdomen (pl. 18, fig. 2) is 5-segmented, the second, third, and fourth segments having spines on the distal margins. The furcal rami are short, the length being two or three times the width, and the inner borders are ciliate. The first basal segments of the fifth foot (pl. 17, fig. 4) have acute spines on the posterior surfaces. The second basal segment of the right foot is much wider at the proximal end, on account of a projection from the inner margin; this projection is armed with long acute spines. A diagonal cuticular ridge on the posterior surface is armed on the proximal third with a row of acute slender spines. About midway of the posterior surface are two stout hairs. There are short hairs on the outer and distal margins. On the posterior surface of the first segment of the exopod of the right foot is a stout hair. From the dorsal surface near the distal end projects a stout blunt process which is about one-half as long as the segment. There is a long hair at the middle of the inner border and short spines at the inner distal angle. The lateral spine of the second segment of the exopod is situated at about the middle of the outer margin, is straight, about as long as the first exopod, and is denticulate on the margins. The terminal hook is falciform, denticulate on the inner margin, and has two short hairs on its base. There is no endopod on the right foot. The second basal segment on the left fifth foot of the male has long acute spines

on its inner margin and a hair on the posterior surface near the inner distal angle. The second segment of the exopod is about equal in length to the first, is curved, its outer margin being convex and its inner concave, and is armed with three blunt spines. The endopod is elongate, of one segment, rounded at the distal end and longer than the first segment of the exopod.

Length, 0.88 mm.

Occurrence.—Found in Rio Culebra, a branch of the Rio Chepo in Panama. Dodds (1926) reported it from Miraflores Lake. This is the only species of *Pseudodiaptomus* that has been found on the Pacific coast of America.

PSEUDODIAPTOMUS GRACILIS (Dahl)

PLATE 18, FIGURES 4-6

Weismannella gracilis DAHL, 1894, p. 11, pl. 1, figs. 12-14.

Pseudodiaptomus gracilis GIESBRECHT and SCHMEIL, 1898, p. 65.—WRIGHT, 1928, pp. 589-592, figs. 1, 2.

Female.—Head and thorax not clearly separated. Last thoracic segment rounded, without spines. The abdomen (pl. 18, fig. 6) consists of four segments. There are processes on each side of the genital aperture. There are spines on the distal margins of the first three segments. The furcal rami are rather short, about four times as long as broad, and ciliate on the inner margins. The first antennae have 20 to 22 segments. Dahl figures 20, and Giesbrecht and Schmeil give the same number; Wright gives 22; the author has found sometimes 20 and sometimes 22. The antennae reach the end of the first abdominal segment. In the fifth feet (pl. 18, fig. 4) the two basal segments and the first exopod have minute spines on their distal borders. There is an acute spine at the outer distal angle of the second segment of the basipod and a rather stout curved spine at the similar position on the first segment. The second segment of the exopod has a strong spine about midway of its outer border. The terminal hook is slender, falciform, and finely dentate on its inner border. At its base is an acute, curved dentate spine; this is the typical inner spine of the genus. The usual spine branching from the base of the hook is, in this species, a slender acute spine applied closely to the hook. It is not shown in Figure 4.

Male.—The fifth foot of the male (pl. 18, fig. 5) has no endopods. The second segment of the basipod of the right foot has hairs on the inner border. The first segment of the exopod has long stiff hairs on its inner border and the outer distal angle is prolonged into a hooklike spine, which nearly reaches the end of the second segment. The second segment of the exopod has an acute spine at about two-

thirds the length of the inner border and a long slender spine at the outer distal angle. The terminal hook is falciform about as long as the exopod; there is a small spine on the inner border. The first segment of the basipod of the left foot has fine spines on its inner border. The second segment is longer than the corresponding segment of the right foot and has hairs on its inner border. The exopod is 3-segmented. The first segment is broader than long, has an acute spine at the inner distal angle, and a short, stout, curved spine at the outer distal angle. The second segment of the exopod is short, armed with spines on its distal margin. The third segment is oval, as long as the rest of the left foot; it has a single acute spine at its distal end.

Length: Dahl, female: 1 mm; male: 0.9 mm. Wright, female: 1.17 mm; male: 1 mm.

Occurrence.—Found in the mouth of the Amazon and as far up the river as Santarem.

Remarks.—Dahl figured a spine by the first antennae of the female, and Giesbrecht and Schmeil use this as a distinguishing characteristic of the genus. Wright stated that "the head bears a pointed process on either side." These spines were not seen in the material studied by the author, but it was noticed that the head has a bifid rostrum.

The form of the terminal segment of the left foot of the male is peculiar and appears in only one other species, *P. clevei*. It should be noticed, too, that the figure published here shows *three* segments in the left exopod of the male fifth foot. In Giesbrecht and Schmeil's synopsis it was stated that the exopods of the male fifth feet are *2-segmented*. Though Wright considered the left exopod 2-segmented, his figure apparently shows three segments. This is the only species in which this exopod consists of three segments.

PSEUDODIAPTOMUS HESSEI (Mrázek)

PLATE 19, FIGURES 1, 2

Schmackeria hessei MRÁZEK, 1894, pp. 1-3, figs. 1-3.

Pseudodiaptomus hessei GIESBRECHT and SCHMEIL, 1898, p. 65.

Female.—The last thoracic segment is rounded. The distal borders of the first three abdominal segments are armed with spines. The furcal rami are about three times as long as wide. The third furcal seta is broader than the others. The first antennae have 22 segments. In the fifth foot (pl. 19, fig. 1) there is a hyaline projection on the second segment of the basipod; the second segment of the exopod has a small acute spine at the outer distal angle, a large plu-

mose spine at the inner distal angle; the terminal spine is elongate, apparently with a hyaline lamella and has a rather long slender spine at its base.

Length, 1.2 mm.

Male.—The right fifth foot (pl. 19, fig. 2) has what may be a rudimentary endopod about midway of the inner border of the second segment of the basipod. The first segment of the exopod is extended at its outer distal angle into a hooklike projection which is about four-fifths as long as the second segment. The second segment of the exopod has a straight, slender, lateral spine near the distal end. The terminal hook is symmetrically curved and is about as long as the two segments of the exopod. The left foot has an irregularly shaped endopod, which reaches nearly to the middle of the second segment of the exopod. The second segment of the exopod is rather broadly expanded, has a spine about midway of the external margin, and has some surface hairs. The left foot reaches the base of the hook of the right foot.

Occurrence.—Found in Banana Creek at the mouth of the Congo.

PSEUDODIAPTOMUS HICKMANI Sewell

PLATE 19, FIGURES 3, 4

Pseudodiaptomus hickmani SEWELL, 1912, p. 364, pl. 22, figs. 1-7.

Female.—The head is separated from the thorax and is somewhat pointed in outline; it has a bifid rostrum. The sides of the last thoracic segment are pointed. The first three abdominal segments have spines on their distal borders. The furcal rami are short, about twice as long as broad, and ciliate on the inner margins. The antennae have 22 segments and nearly reach the second abdominal segment. The second segment of the exopod of the fifth foot (pl. 19, fig. 3) has a very small spine at the outer distal angle; it terminates in two stout spines of nearly equal length, the inner one bearing a dentate lamella. The spine representing the hook has a small blunt spine on its base.

Length, 1.37 mm.

Male.—The terminal portion of the right antenna has three segments. In the right fifth foot (pl. 19, fig. 4) the second segment of the basipod has a Y-shaped endopod, the two branches having bifid tips. The exopod has three segments. From the base of the first segment of the exopod springs a Y-shaped process. The second segment of the exopod has a row of small spines at its outer distal angle, and at the inner distal angle a stout serrate spine. The terminal hook is stout and denticulate. An endopod on the left foot reaches to more than half the length of the second segment of the exopod.

The first segment of the exopod is short with a spine at the outer distal angle; the second segment of the exopod is a flat plate, squarely truncate at the distal end; it has a spine at each distal angle and the distal margin is finely denticulated.

Length, 1.3 mm.

Occurrence.—Found in Burma.

PSEUDODIAPTOMUS PELAGICUS Herrick

PLATE 19, FIGURES 5, 6; PLATE 20, FIGURE 2

Pseudodiaptomus pelagicus HERRICK, 1884, p. 181; 1887, pp. 10, 11, pl. 1, fig. 8, pl. 2, figs. 1-8.—HERRICK and TURNER, 1895, p. 53, pl. 1, figs. 11-17.—GIESBRECHT and SCHMEIL, 1898, p. 64.

Female (pl. 19, fig. 5).—Head rounded, beaked, and separated from the thorax. The sides of the last thoracic segment are pointed. The abdomen has three segments. The furcal rami are elongated and have spines on the margins. The first antennae have 22 segments and extend to the furca. In the fifth feet (pl. 19, fig. 6) the first segment of the exopod is elongate, and has a spine at the inner distal angle and a group of small spines on the distal third of the inner margin. At distal end of the second segment of the exopod there is an external spine and a stout internal spine. The terminal hook is falciform, dentate on the inner border, and much longer than the second segment of the exopod. Ovisac single.

Male.—In the male fifth foot (pl. 20, fig. 2) the second segments of the basipods are armed, on the inner borders, with a mass of rather coarse spines. The first segment of the exopod of the right foot has a row of spines on its inner border and two rather long spines, one near the proximal end and the other at the inner distal angle. The lateral spine of the second segment of the right exopod is situated at about three-fourths the length of the segment. The terminal hook is about as long as the two segments of the exopod. The second segment of the basipod of the left foot has, besides the spines of the inner border, four spines on the outer border. There is a spinelike endopod that exceeds the length of the first segment of the exopod. The first segment of the exopod has a slender spine at its outer distal angle. The second segment is twice as long as the first and terminated by four spines.

Occurrence.—Found in Mississippi Sound.

Remarks.—The description is from the statements and figures of Herrick. No other collections of the species have been reported. The figures are taken from Herrick; while they are diagnostically sufficient, there is some question of their accuracy, especially of those of the fifth feet.

PSEUDODIAPTOMUS RICHARDI (Dahl)

PLATE 20, FIGURES 1, 3

Weismanella richardi DAHL, 1894, p. 11, pl. 1, figs. 6-8.

Schmackeria richardi POPPE and MRÁZEK, 1895, p. 5.

Pseudodiaptomus richardi GIESBRECHT and SCHMEIL, 1898, p. 64.—MRÁZEK, 1901, p. 14, figs. 14, 29.—PESTA, 1927, p. 71, fig. 2, b-d.

Pseudodiaptomus richardi var. *inaequalis* BRIAN, 1926, pp. 187, 188, figs. 15, 16.

Female.—The head is not directly separated from the thorax. The sides of the last thoracic segment are rounded. The abdomen has four segments and the distal borders of the segments do not have spines. The furcal rami are short. The first antennae have 20 (21 according to Brian) segments and reach the second abdominal segment. The fifth feet (pl. 20, fig. 3) are much like those of *P. pelagicus* and *P. coronatus*, the terminal segment having, besides the hook, a small acute external spine, and a stout internal spine. The left egg sac is much more developed than the right, containing 10 to 12 ova, while the right has 4 or 5.

Length, 1.4 mm.

Male.—The right fifth foot (pl. 20, fig. 1) resembles closely that of *P. coronatus*, but does not have the stout spine that in *P. coronatus* is found on the first segment of the basipod. It has the flask-shaped spine on the first segment of the exopod which is found in *coronatus*; this is shown in Dahl's figure and in the figure of Brian's variety *inaequalis*. The left foot has an endopod extending to about one-half the length of the second segment of the exopod. The first segment of the exopod is short, the second about as long as broad. The second segment of the exopod is truncate at the distal end; the distal margin is dentate; there is a slender curved spine at the inner distal angle and at the base of this spine a short stout spine.

Length, 1 mm.

Occurrence.—Found in brackish water at the mouths of the Amazon, the La Plata, and the Parana Rivers.

Remarks.—*P. richardi* var. *inaequalis* Brian differs from the type in that the last thoracic segment of the female is prolonged backward into lobes, which are armed with spines.

PSEUDODIAPTOMUS SALINUS (Giesbrecht)

PLATE 20, FIGURES 4, 5

Schmackeria salina GIESBRECHT, 1896, pp. 322, 323, pl. 6, figs. 23-28.

Pseudodiaptomus salinus GIESBRECHT and SCHMEIL, 1898, p. 65.—THOMPSON and SCOTT, 1903, p. 248, pl. 2, figs. 21-23.

Female.—The head is not distinctly separated from the thorax. The wings of the last thoracic segment are pointed. The abdomen

has four segments: the third segment has spines on its distal border, but there are more on the other segments. The furcal rami are short. The terminal hook of the exopod of the fifth foot (pl. 20, fig. 4) is only slightly curved; in addition to the hook the terminal segment has a small external spine, a stout spine at the inner base of the hook, and an internal spine broadened by a dentate hyaline lamella.

Length, 1.25 mm.

Male.—There are endopods on both fifth feet. (Pl. 20, fig. 5.) The endopod of the right foot is bifid, one branch terminating in a spine and the other having short hairs. The first segment of the exopod has hairs on the inner distal margin and a long slender spine on the outer margin. The lateral spine of the second segment of the exopod is at the distal end. The terminal hook is serrate on the inner margin and in addition to the small spine on the inner margin of the base, has a curved spine on the outer margin. The endopod of the left foot is 1-segmented, slender, and extends about one-half the length of the second segment of the exopod. The first segment of the exopod is slightly longer than wide and has a long slender spine at the outer distal angle. The second segment of the exopod is expanded, the outer margin a regular curve, the inner sinuate, ending in a point directed inward. There are two external spines on this segment and one internal situated near the distal end.

Length, 1.25 mm.

Occurrence.—Found in Red Sea, Gulf of Suez, and Indian Ocean.

PSEUDODIAPTOMUS STUHLMANNI (Poppe and Mrázek)

PLATE 20, FIGURES 6, 7

Schmackeria stuhlmanni POPPE and MRÁZEK, 1895, pp. 6, 7, pl. 1, figs. 1-9.

Pseudodiaptomus stuhlmanni GIESERECHE and SCHMEIL, 1898, pp. 65, 66, fig. 16.

Female.—The head is narrowly rounded. The wings of the last thoracic segment are pointed. The abdomen has four segments; there are spines on the distal borders of the first three segments. The furcal rami are rather short. The first antennae have 21 segments and do not reach the end of the first abdominal segment. In the fifth foot (pl. 20, fig. 6) the second segment of the basipod has a rounded projection on its inner margin; the second segment of the exopod has a small external spine, a rather short hook with a spine branching from its base and an internal spine, which has a narrow hyaline lamella.

Length, 1.4 mm.

Male.—On the inner margin of the first segment of the basipod of the right fifth foot (pl. 20, fig. 7) is a stout claw projecting inward; from this segment, too, is a slender spatulate endopod, which

reaches to about the end of the first segment of the exopod. The first segment of the exopod has patches of small spines on its posterior surface and the outer distal angle is extended in a spine which exceeds two-thirds the length of the second segment; the lateral spine of the second segment is near the distal end. The terminal hook is falciform and about as long as the two segments of the exopod. The left foot has a flask-shaped endopod, the base broad and the distal end pointed. The second segment of the exopod is broadened, pointed at the distal end, and has a spine on its outer border.

Length, 1.3 mm.

Occurrence.—Found in Quilimane River, East Africa.

Remarks.—*P. stuhlmanni*, *P. salinus*, and *P. hessci* are very closely related, but are clearly distinguished by details of the fifth feet of the male.

Genus SCHMACKERIA Poppe and Richard, 1890

From *Pseudodiaptomus* as generally recognized may be separated those species in which the second segment of the basipod of the left fifth foot of the male is armed, on its inner border, with a long curved projection resembling, in some cases, the similar structure in *Epischura*. In all these species the last thoracic segment of the female is rounded. In other respects they do not differ from the recognized diagnosis of *Pseudodiaptomus*. For these species the generic name *Schmackeria* is revived, as *S. forbesi* was one of these species and was made by Poppe and Richard the type of the genus *Schmackeria*.

Occurrence.—*Schmackeria* occurs in India, China, Celebes, the Philippines, and Africa; only one species, *S. serricaudatus*, is found in Africa.

Our knowledge of this genus as well as of *Pseudodiaptomus* is very incomplete, and a discussion of the causes of distribution and the genesis of the forms is impossible at the present time.

KEY TO THE SPECIES OF SCHMACKERIA

- 1. Two processes on second segment of basipod of left fifth foot of male..... 2
 One process on second segment of basipod of left fifth foot of male..... 4
- 2. Both processes springing from second basipod..... 3
 One process springing from basipod, the other a branch of the first..... *smithi* Wright
- 3. Process on second segment of basipod of right fifth foot of male with a spine and a lobular branch, corresponding to an endopod; female having a single spine on dorsal surface of last thoracic segment..... *tollingeri* (Sewell)

- No process on second segment of basipod of right fifth foot of male; in female two spines on dorsal surface of last thoracic segment ----- *poppei* (Stingelin)
4. An endopod on right fifth foot of male ----- 5
 No endopod on right fifth foot of male ----- 6
5. Process of second basipod of left fifth foot of male consisting of a broad blunt-pointed expansion of the segment ----- *annandalei* (Sewell)
 Process of second segment of basipod of left fifth foot of male long, slender, and sinuate ----- *serricaudatus* (T. Scott)
6. Process of second segment of basipod of left fifth foot of male having a broad spine on its dorsal border near the base, perhaps indicative of the 2-branched condition seen in *smithi*, *tollingeri*, and *poppei* ----- 7
 Process having no spine or indication of division ----- 8
7. All furcal setae of female of approximately same width; external spine of first segment of right exopod of male as long as second segment ----- *forbesi* Poppe and Richard
 Third furcal seta of female much broader than others; external spine of first segment of right exopod of male shorter than second segment ----- *inopinus* Burckhardt
8. In male process of second segment of basipod of left fifth foot pointed; in female third furcal seta broader than others. *binghami* (Sewell)
 In male process of second segment of basipod of left fifth foot rounded; in female furcal setae of approximately equal width ----- *lobipes* (Gurney)

SCHMACKERIA ANNANDALEI (Sewell)

PLATE 20, FIGURE 8; PLATE 21, FIGURE 1

Pseudodiptomus amandalei SEWELL, 1919, pp. 5-7, pl. 10, fig. 9; 1924, p. 787 pl. 44, fig. 2.

Female.—The head is fused with the first thoracic segment. The rostrum is bifid. The last thoracic segment is rounded and has on each side a comb of six to eight coarse teeth. The abdomen has four segments. The first segment is produced on each side into a large recurved spine. Segments 2 and 3 have spines on the distal borders. The furcal rami are short and ciliate on the inner borders. The third seta is much broader than the others. The first antennae have 21 segments and reach the second abdominal segment. In the fifth foot (pl. 21, fig. 1), according to Sewell's figure, it appears probable that the second segment of the exopod has a small outer spine, a hook with a long slender spine from its base, and a rather broad inner spine; it seems that the separation of the hook from the second segment of the exopod is not shown in the figure.

Length, 1.18 mm.

Male.—Sewell states that the male fifth foot consists of *three segments*, which he considers as belonging to the exopod. An examination of his figure (pl. 20, fig. 8), which, evidently, was imperfectly

drawn, makes it fairly certain that in this species, as in others of the genus, each foot consists of a 2-segmented basipod and a 2-segmented exopod. In the right foot the second segment of the basipod, not as stated by Sewell the *first* segment of the exopod, has a row of spines on its outer margin and from its inner margin a bifid process which is probably an endopod. The long spinelike process with the short recurved hook must be the long spine which is usually present on the outer distal angle of the first segment of the exopod. The separation between the first and second segments of the exopod is not shown in the figure. The terminal hook is broad. Using a similar interpretation in regard to the segments of the left foot, we may describe it as follows: The second segment of the basipod is expanded internally into a broad process, doubtless representing the endopod. The first segment of the exopod has a blunt process and a spine on its inner border. The second segment of the exopod has a stout dentate spine on its outer margin at about one-third the length of the segment; it terminates in a blunt point, which has, on the inner side, a blunt spine.

Length, 1.09 mm.

Occurrence.—Found in Chilka Lake, India.

SCHMACKERIA BINGHAMI (Sewell)

PLATE 21, FIGURES 2, 3

Pseudodiaptomus binghami SEWELL, 1912, pp. 337, 338, pl. 17, figs. 8–11; 1919, pp. 7–9; 1924, p. 786, pl. 45, fig. 2.

Female.—The head is fused with the first thoracic segment. The rostrum is bifid. The last thoracic segment is rounded and has a small spine near the dorsal surface. The abdomen has four segments, the first three having spines at the distal ends. The furcal rami are rather short and symmetrical, and are ciliate on the inner border. The third terminal seta is much broader than the others. The terminal segment of the fifth foot (pl. 21, fig. 3) has besides the terminal hook a small external spine, a stouter internal spine, and from the base of the hook a slender spine equaling in length the one at the inner angle.

Length, 1.3 mm.

Male.—In the right fifth foot (pl. 21, fig. 2) there is a prominent rounded process on the interior of the terminal hook about midway of its length. The process of the second segment of the basipod of the left foot is long, curved, and pointed. The second segment of the left exopod is a broad, oval plate having a spine about midway of its outer border and a row of small spines on the inner border near the proximal end.

Length, 0.86 mm.

Occurrence.—Found in India.

Remarks.—This species in many respects is almost identical with *S. lobipes* of Gurney. There are, however, minor differences in the fifth feet of both sexes, and the broad third furcal seta of *S. binghami* makes a definite difference.

SCHMACKERIA FORBESI Poppe and Richard

PLATE 21, FIGURES 4, 5, 7

Schmackeria forbesi POPPE and RICHARD, 1890, pp. 1-8, pl. 10, figs. 1-14.

Pseudodiaptomus forbesi GIESBRECHT and SCHMEIL, 1898, p. 66.—BURCKHARDT, 1913, pp. 379-394, pl. 11E, figs. 1-6, pl. 11F, figs. 5-8, pl. 11G, figs. 5-9, pl. 12H, figs. 5, 6, 9.—KIKUCHI, 1928, pp. 69, 70, pl. 19, figs. 19, 20.

Female.—The head and first thoracic segment are fused. The sides of the last thoracic segment are rounded and armed with hairs. The abdomen has four segments. The first three abdominal segments (pl. 21, fig. 7) have spines on their distal borders. The first antennae have 22 segments and extend to the second abdominal segment. The furcal rami are about four times as long as the width and are ciliate on the inner border. In the fifth foot (pl. 21, fig. 5) the two segments of the exopod are short; the first segment has a spine at the outer distal angle and a hyaline plate at the inner angle. The second segment has an external lateral spine, a terminal elongated hook, and a stout dentate internal spine.

Male.—In the fifth foot (pl. 21, fig. 4) the second segment of the right basipod has two tuberos projections on the inner border. The long external spine of the first segment of the exopod about equals the length of the second segment. The falciform terminal hook is about as long as the whole exopod. In the left foot the second segment of the exopod has from its inner border a long, slender, curved process projecting distal. This process has, from its base, a sharp branch about one-half as long as the second segment of the exopod. The second segment of the exopod is a bilobed plate.

Length: According to Poppe and Richard, female: 1.2 mm; male: 1.15 mm. According to Burckhardt, female: 1.35 mm; male: 1.12 mm.

Occurrence.—Found in China in the Yangtze Kiang and connecting waters.

SCHMACKERIA INOPINUS Burckhardt

PLATE 21, FIGURE 6; PLATE 22, FIGURE 1

Schmackeria inopinus BURCKHARDT, 1913, pp. 379-394, pl. 11E, figs. 2-5, pl. 11F, figs. 1-4, 9, 10; pl. 11G, figs. 1-4, 6-8, pl. 12H, figs. 1-4, 7, 8, 10, 11.

Pseudodiaptomus japonicus KIKUCHI, 1928, pp. 68-70, pl. 19, figs. 19, 20.

Pseudodiaptomus inopinus SMIRNOV, 1929, pp. 318-320, figs. 1-3.

Schmackeria inopinus resembles *S. forbesi* so closely that it is somewhat difficult to separate them without examination of the

females. In the female furca (pl. 22, fig. 1) the third seta is much broader than the others. There is no difference in the female fifth feet. In the male fifth feet (pl. 21, fig. 6) the spine at the distal end of the first segment of the right exopod about equals the second segment in *forbesi*, but is shorter in *inopinus*. Burekhardt also makes the depression in the terminal segment of the left foot which separates the two lobes sharper in *forbesi* than in *inopinus*, stating that it is 30° or 40° as compared with 90° ; it is doubtful whether this distinction will hold.

If it were not for the difference in the furcal setae, one might be inclined to think of *inopinus* as simply a variety of *forbesi*. *S. inopinus* is somewhat smaller than *forbesi*.

Length: Female, 1.15 mm; male, 1.03 mm.

Occurrence.—Found in the Yangtze Kiang. It belongs more distinctly to the plankton than does *forbesi*.

SCHMACKERIA LOBIPES (Gurney)

PLATE 22, FIGURES 4, 7, 8

Pseudodiaptomus lobipes GURNEY, 1907, pp. 27, 28, pl. 1, figs. 4–8.—SEWELL, 1924, p. 786, pl. 45, fig. 1.

Female.—The head is fused with the first thoracic segment. The last segment of the thorax is rounded, and has a small spine on each side. The abdomen has four segments, the first three having spines on the distal borders. The furcal rami are ciliate on the inner borders. The antennae have 21 segments and extend to the abdomen. In the fifth feet (pl. 22, fig. 4) the first segment of the exopod, in addition to the external distal spine, has, near the internal distal angle, a small oval projection. The second segment of the exopod has, besides the terminal hook, small spines of about equal length at the internal and external distal angles and a longer spine between the hook and the spine of the inner distal angle.

Male.—In the right fifth foot (pl. 22, fig. 7) there is a prominent rounded process on the interior of the terminal hook about midway of its length. The process of the second segment of the basipod of the left foot (pl. 22, fig. 8) is long, curved, and rounded at the end. The second segment of the left exopod is an oval plate with a spine about midway of its outer border and a row of small spines about midway of the inner border.

Length: Female, 0.35 mm; male, 0.95. These are measurements given by Gurney and must be incorrect; possibly the female is 1.35 mm.

Occurrence.—Found in Calcutta, India.

SCHMACKERIA POPPEI (Stingelin)

PLATE 22, FIGURES 5, 6; PLATE 23, FIGURE 1

Pseudodiaptomus poppei STINGELIN, 1900, pp. 200-204, pl. 14, figs. 6-10.

Female.—The head and the first thoracic segment are fused. The sides of the last thoracic segment are rounded; there are two dorsal spines on this segment and rows of small spines on its sides. The abdomen has four segments; the first three segments have spines on their distal borders. The first antennae have 22 segments. In the fifth foot (pl. 23, fig. 1) the first segment of the exopod has a rather stout external spine and a marked projection of the inner distal angle. The second segment of the exopod has an elongated terminal hook with a hook-shaped branch at its base, a stout terminal spine, and a small lateral spine.

Length, 1.36 mm.

Male.—In the right fifth foot (pl. 22, fig. 5) the exopod consists of three segments. The first segment has a spinous projection, which is as long as the second segment; the second segment has a short spine at the distal third of the outer border; the third segment is irregularly curved and about equal in length to the second segment; the terminal hook is short, nearly straight, and its sides are armed with short hairs. The second segment of the basipod of the left foot (pl. 22, fig. 6) has two processes extending distad to about the end of the first segment of the exopod; one process is spatulate and the other pointed. The first segment of the exopod has a spine at its outer distal angle. The second segment of the exopod is longer than the first, is irregular in outline and is lobed at the distal end; it has a stout dentate spine about midway of the outer border, a group of hairs about midway of its inner border, and, at the end, five short curved spines.

Length, 1.1 mm.

Occurrence.—Found in a pond in Celebes.

SCHMACKERIA SERRICAUDATUS (T. Scott)

PLATE 22, FIGURES 2, 3

Heterocalanus serricaudatus T. SCOTT, 1893, pp. 40, 41, pl. 2, figs. 43-48, pl. 3, figs. 1-7.

Pseudodiaptomus serricaudatus GIESBRECHT and SCHMEIL, 1898, p. 66.—A. SCOTT, 1902, p. 404, pl. 1, fig. 6.

Female.—Head narrowly rounded. The sides of the last thoracic segment are rounded and bear several small spines. The abdomen is 4-segmented, and the distal borders of the first three segments are armed with spines. The branches of the furcal rami are comparatively short. The first antennae have 22 segments and reach the third abdominal segment.

In the fifth foot (pl. 22, fig. 2) the terminal segment has a stout serrate hook at the inner angle, a slender spine at the outer angle, and a third shorter median spine.

Length, 1.15 mm.

Male.—The endopod of the right foot (pl. 22, fig. 3) is a dentate plate extending about one-half of the length of the first segment of the exopod. The first segment of the exopod has at its distal angles spinelike processes. The second segment of the exopod has a long, slender spine at its outer distal angle. The terminal hook is falciform, with a tumid base on which are two small spines. The left foot has, on the second segment of the basipod, a long slender sigmoid appendage, the endopod; this has short hairs on both inner and outer sides. Both segments of the exopod have elongated hooks; the second segment has, besides, a border of long hairs on the inner side of the base of the hook.

Length, 1.15 mm.

Occurrence.—Found in salt and brackish water in Gulf of Guinea, Red Sea, India, and Cape Colony.

SCHMACKERIA SMITHI Wright

PLATE 23, FIGURES 3, 4

Schmackeria smithi WRIGHT, 1928, pp. 592-597, pl. 12, figs. 1-3, 5-8.

Female.—The head and first thoracic segment are fused. There is a small spine on each side of the head. The sides of the last thoracic segment are rounded; there is a strong spine on the dorsal surface of the last thoracic segment on each side. The abdomen has four segments. Segments 1 to 3 have spines on the distal borders. The first segment has a rather prominent spine on each side. The antennae have 22 segments and extend to the second abdominal segment. The furcal rami are asymmetrical, and ciliate on the inner borders; the third seta is broader than the others. The second basal segment of the fifth foot (pl. 23, fig. 4) is approximately square, its inner and outer borders being convex. The first segment of the exopod has a spine near the outer distal angle and a hyaline lamella on the inner angle. The second segment of the exopod has a small external spine at the distal end, a stout, curved internal spine. The terminal hook is slightly curved and has a hook-shaped branch from the inner side of the base.

Length, 1.16 mm.

Male.—In the right fifth foot (pl. 23, fig. 3) a triangular process, the endopod, projects from the second basal segment. The first segment of the exopod is extended in a curved process which is dentate on the outer margin. The second segment of the exopod is

broad and of irregular form; it has a small spine on the inner border and a stout spine distad of the middle of the outer borders. The terminal hook has a rounded projection about midway of the inner margin. In the left foot the second basipod is expanded into two irregular processes extending distad. From the distal base of these processes is a lobular process on which is a small spine. The processes doubtless represent the endopod. The second segment of the exopod is rounded at the end; it has a stout dentate spine about midway of the outer border, a small spine on the inner border, and a small spine at the end.

Length, 0.96 mm.

Occurrence.—From Manila, Philippine Islands.

SCHMACKERIA TOLLINGERI (Sewell)

PLATE 23, FIGURE 2

Pseudodiptomus tollingeri SEWELL, 1919, pp. 2-5, pl. 10, fig. 8.

Female.—The head and first thoracic segment are fused. The rostrum is bifid. The last thoracic segment has a single spine situated toward the dorsal surface. The abdomen has four segments, the first three with spines at the distal ends. The genital segment has a transverse row of spines across the ventral side anterior to the genital opening. The third furcal seta is broader than the others. There are two egg sacs. The first antennae have 21 segments and extend to the second abdominal segment. Following is the description of the fifth foot as given by Sewell:

Each consists of a three-jointed exopod only * * * The second segment is produced at its distal internal angle in a lamelliform process which terminates in a sharp point: externally there is a single small needle-like spine. The third segment bears three spines and is produced externally in a bluntly rounded process; of the three spines, the outer is long and curved and in length is nearly equal to the whole limb; it is finely serrated along both borders: the middle spine is straight, about half the length of the outer one and is serrated on both margins; the inner spine is somewhat curved and is short and stout with coarse serrations on its inner, and fine teeth on its outer, border.

No figure of the female fifth foot is given, and from the above description it is impossible to make an intelligent description of the foot.

Length, 1.34 mm.

Male.—Plate 23, Figure 2, is a reproduction of Sewell's figure of the fifth feet. It is evident that he has omitted the first segments of the basipods. With this omission assumed, the following description has been prepared: From the second segment of the basipod of the right foot is a projection terminating in a spine and with a lobular branch on its external side; this probably is the endopod. The spinous prolongation of the external distal angle of the first segment of

the exopod reaches about one-half the length of the second segment. The terminal hook has a rounded dentate process on its inner border at about two-thirds of its length. The left foot has two elongated processes from the second segment of the basipod, one or both representing the endopod. The terminal segment has a stout dentate spine on its outer border and terminates in three pointed processes.

Length, 1.2 mm.

Occurrence.—Found in India in brackish water.

SENECELLIDAE, new family

Genus *SENECELLA* Juday, 1923

SENECELLA CALANOIDES Juday

PLATE 24

Senecella calanoides JUDAY, 1923, p. 205; 1925, pp. 1-6, pls. 1-3.

Female.—The head is indistinctly separated from the thorax; it has no rostrum or rostral filaments. The last thoracic segment is rounded and not expanded laterally. The abdomen (pl. 24, fig. 7) has four segments. The first segment exceeds in length the other three. The caudal rami are short and have short hairs on both the inner borders and the surface. The first antennae reach the second abdominal segment. The exopod of the second antenna (pl. 24, fig. 3) has seven segments. The first feet have 1-segmented endopods; the second, 2-segmented; and the third and fourth, 3-segmented. The endopod of the first foot has a ciliate shoulder or tuberos prominence (pl. 24, fig. 5) at about one-half the length of its outer border. The first basal segment of the fourth feet has, on its inner margin (pl. 24, fig. 2), a blunt spine, which has the appearance of a broken seta. The fifth feet are lacking.

Length, 2.65 mm to 2.88 mm.

Male.—The abdomen (pl. 24, fig. 6) is composed of four segments; the furcal rami are very short and have short hairs. Juday states that the male abdomen has five segments and has so figured it. An examination of a number of preparations by the author has failed to show the separation of the fifth segment. The caudal rami are shorter than in the female.

The right antenna is not geniculate, but is like the left. The mandible, maxillae, and maxilliped are smaller than in the female. The endopod of the first swimming foot is like that of the female. The first basal segment of the fourth foot (pl. 24, fig. 1) in place of the blunt spine found in the female has a cuplike depression in which there is a minute, acute spine.

On the right fifth foot (pl. 24, fig. 8) the endopod is slender, pointed, and extends beyond the second segment of the exopod. The

first segment of the exopod is about twice as long as broad and has a small spine on its outer margin at about three-fourths of its length. The second segment of the exopod is one-third as long as the first; it has a small curved spine near the distal end; this spine is turned inward across the segment. A narrow hyaline lamella extends along the inner side of the second segment and the base of the hook. The terminal hook is slender, recurved at the tip, and nearly as long as the whole right foot.

The second basal segment of the left foot (pl. 24, fig. 4) is twice as long as broad. The endopod is a triangular plate with sides about as long as the first segment of the exopod; the outer distal angle is drawn out in a slender, pointed process about as long as the sides of the endopod. The second segment of the exopod has a convex outer margin and a concave inner; there is a protuberance at the inner proximal angle and a small digitiform process and a spine at the termination.

Length, 2.45 mm to 2.55 mm.

Occurrence.—This species was first described from collections from Seneca, Cayuga, and Owasco Lakes, N. Y. It has also been found in Lake Timagami and Lake Nipigon in Canada. In 1894 the author found immature specimens of an unnamed copepod in Pine Lake, Mich. In 1898 he received from A. J. Woolman similar material collected in Lake Superior. It is now evident that both of these collections were of *Senecella calanoides*. It is characteristic of deep water and may eventually be found to have a wide distribution.

Remarks.—Juday correctly assigned this form to a new genus. It seems clear too that it must be placed in a new family, as it does not correspond to any recognized family. Therefore, the family name Senecellidae is here introduced for this interesting form.

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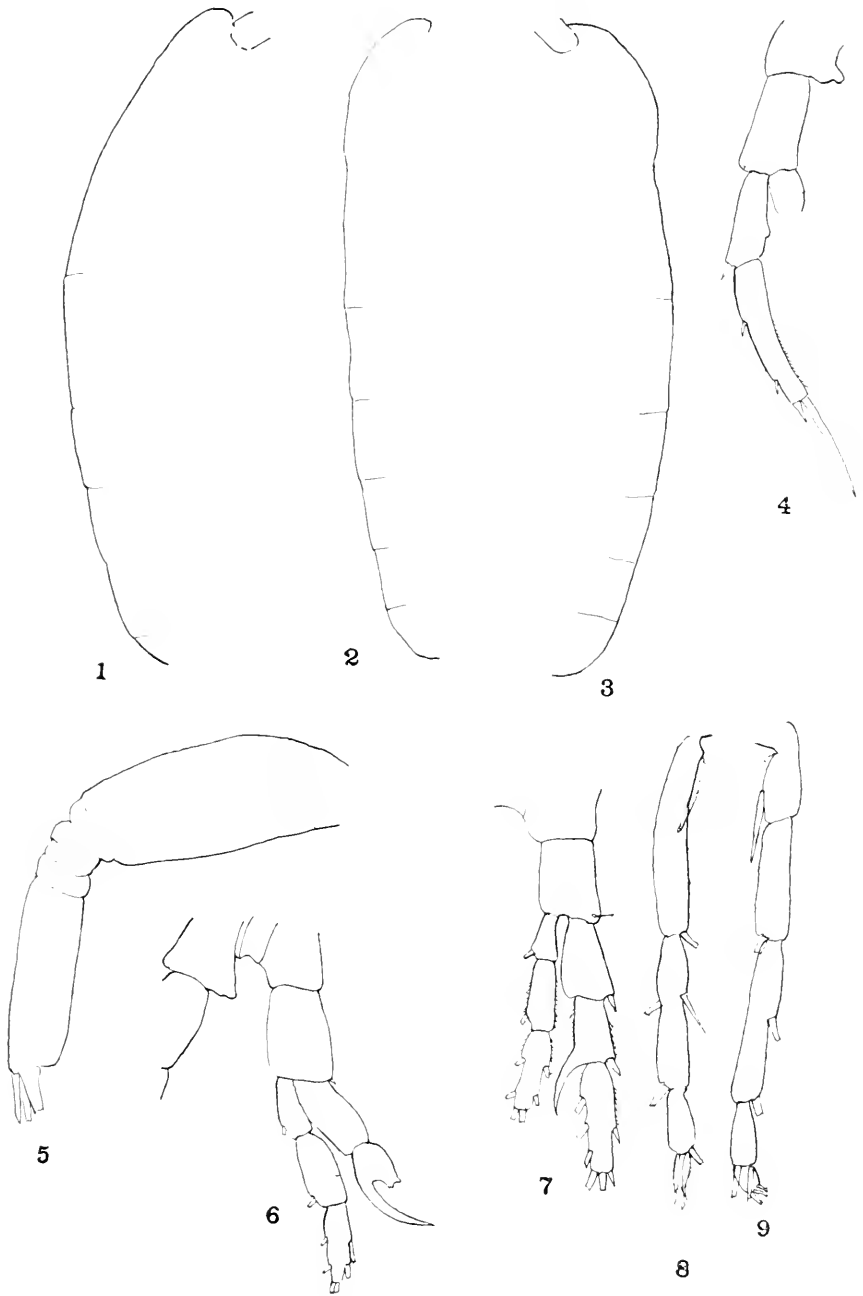
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MARSH

[IN THIS posthumous work, it seems fitting to present a full list of Doctor Marsh's contributions to the literature of the copepod crustaceans, on which he was a leading authority. The following bibliography was compiled by Miss Lucile McCain, of the division of marine invertebrates, and comprises 35 titles of papers published over a period of 43 years. A painstaking attempt has been made to make it complete, and several copepod specialists have cooperated by supplying titles.—EDITOR.]

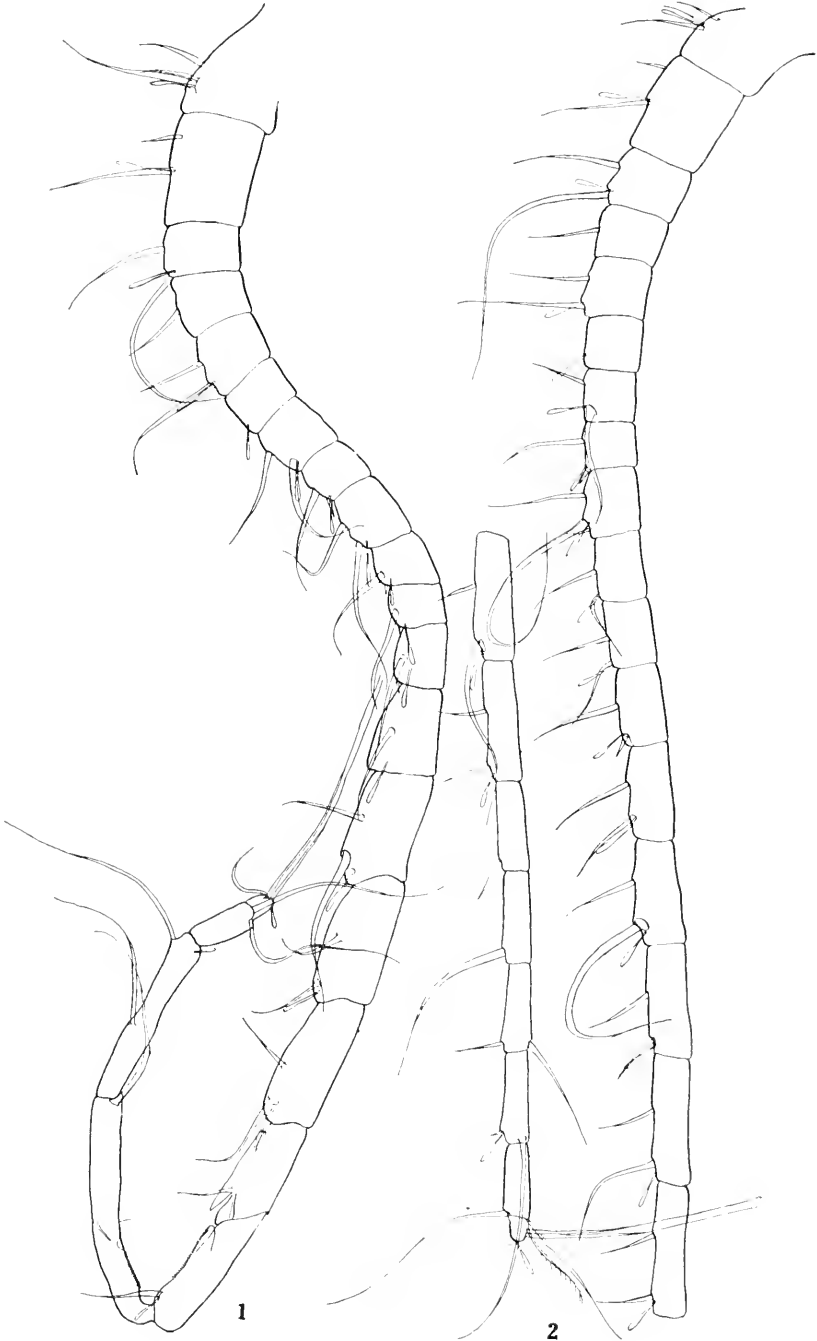
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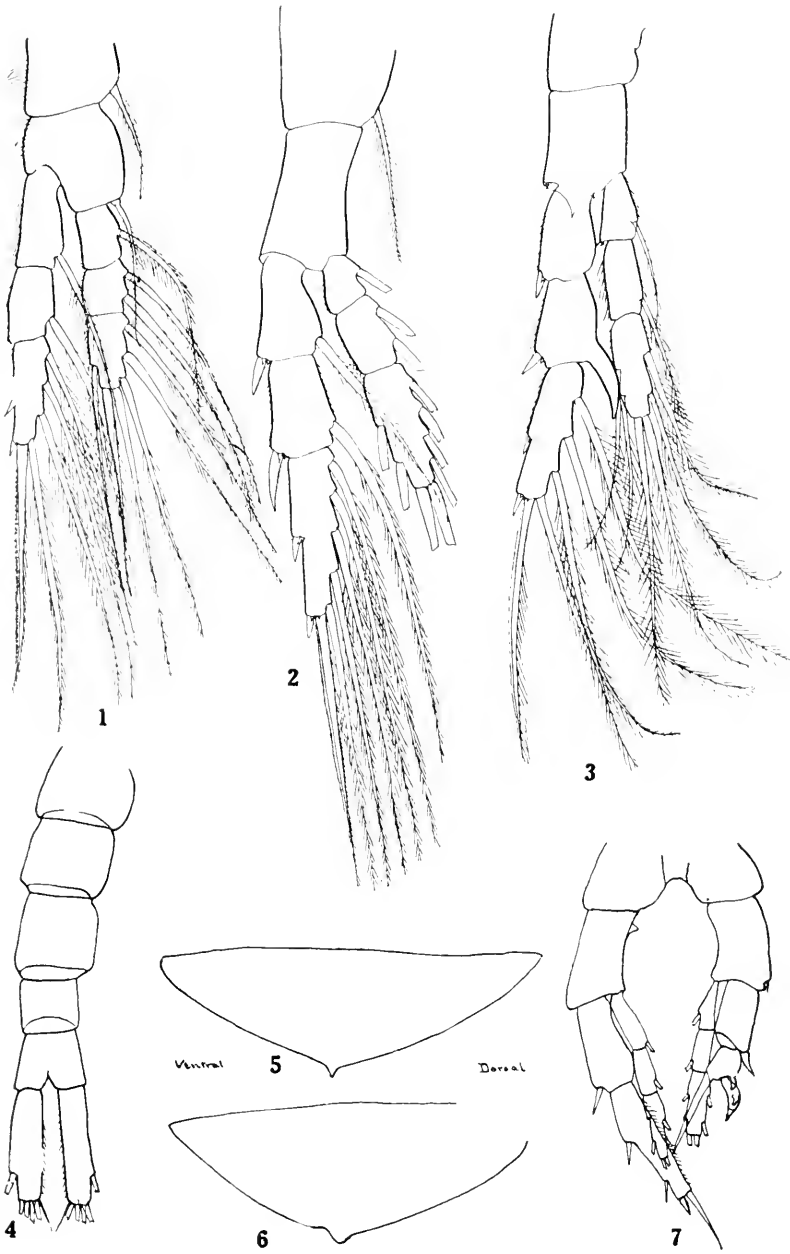
SPECIES OF LIMNOCALANUS

- 1, 8, 9 *Limnocalanus johanseni*: 1, Profile of cephalothorax of female; 8, 9, terminal segments of right antenna of male.
 2, 3, 5. *Limnocalanus macrurus*: 2, 3, Profiles of cephalothorax of male; 5, exopod of second antenna.
 4, 6, 7. *Limnocalanus grimaldii*: 4, Exopod of left fifth foot of male; 6, right fifth foot of male; 7, fifth foot of female.



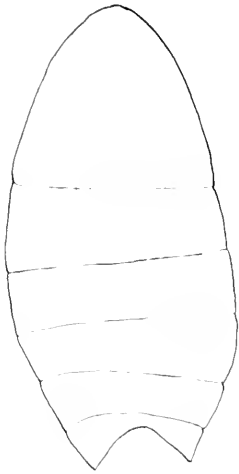
LIMNOCALANUS MACRURUS

- 1. Right first antenna of male.
- 2. Left first antenna of male.

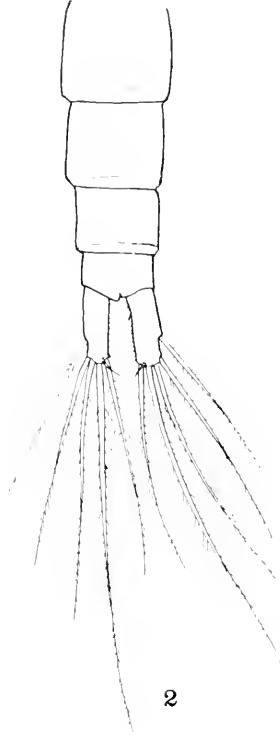


SPECIES OF LIMNCCALANUS

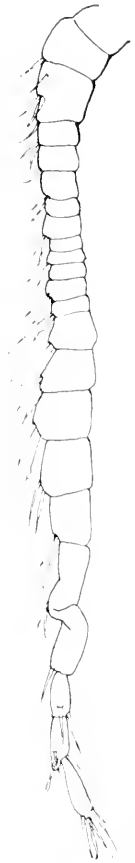
1-3. *Limnocalanus macrurus*: 1, First swimming foot; 2, second swimming foot; 3, fifth foot of female.
 4-7. *Limnocalanus johauseni*: 4, Abdomen of male; 5, 6, last thoracic segments; 7, fifth feet of male.



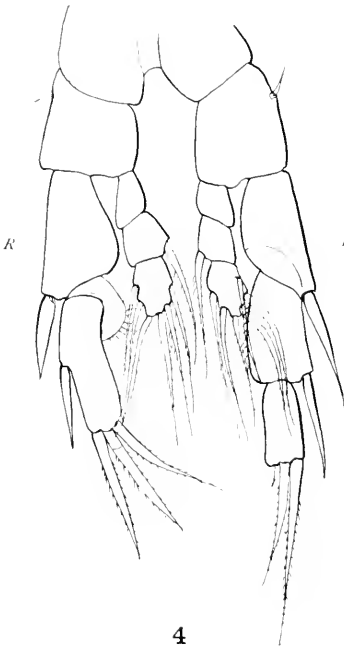
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OSPHRANTICUM LABRONECTUM

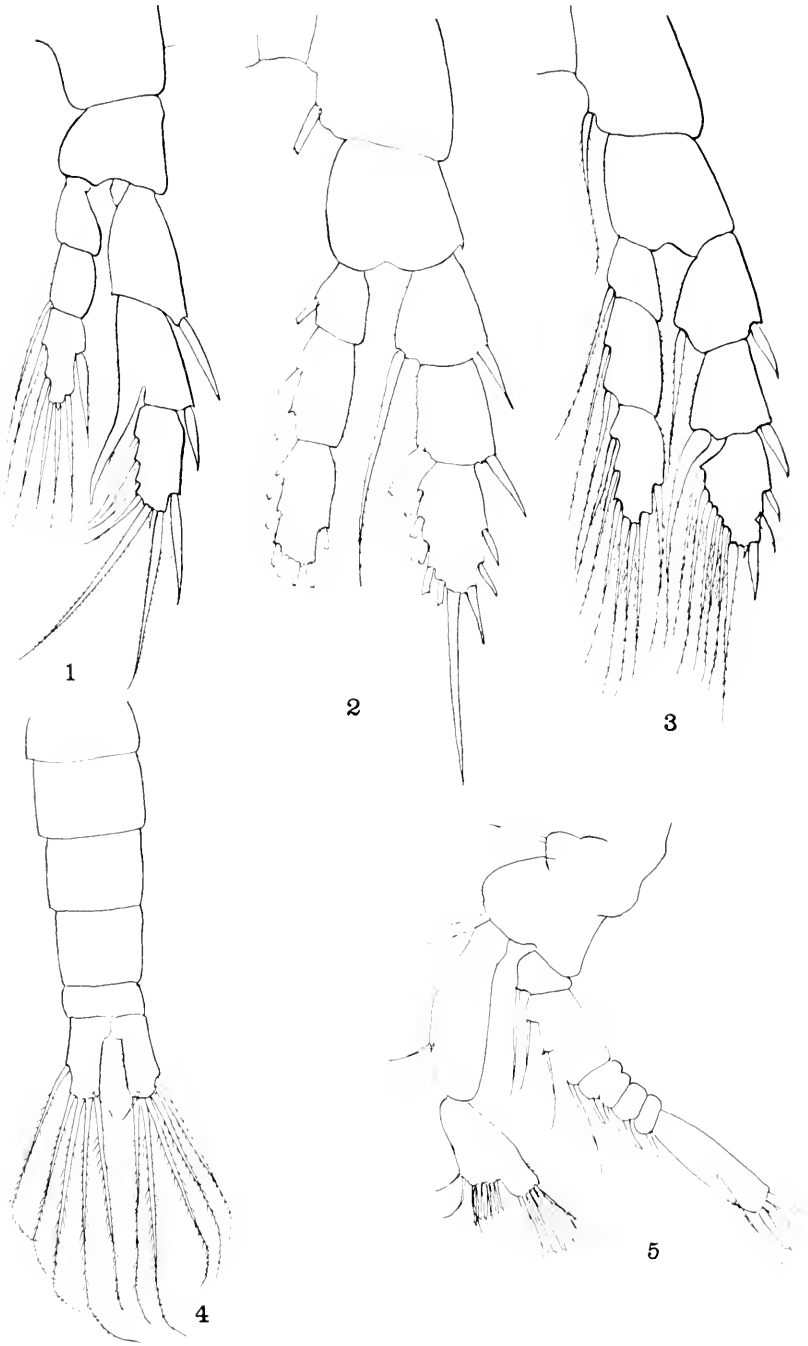
1. Cephalothorax of female.

2. Abdomen of female.

3. Right first antenna of male.

4. Fifth feet of male.

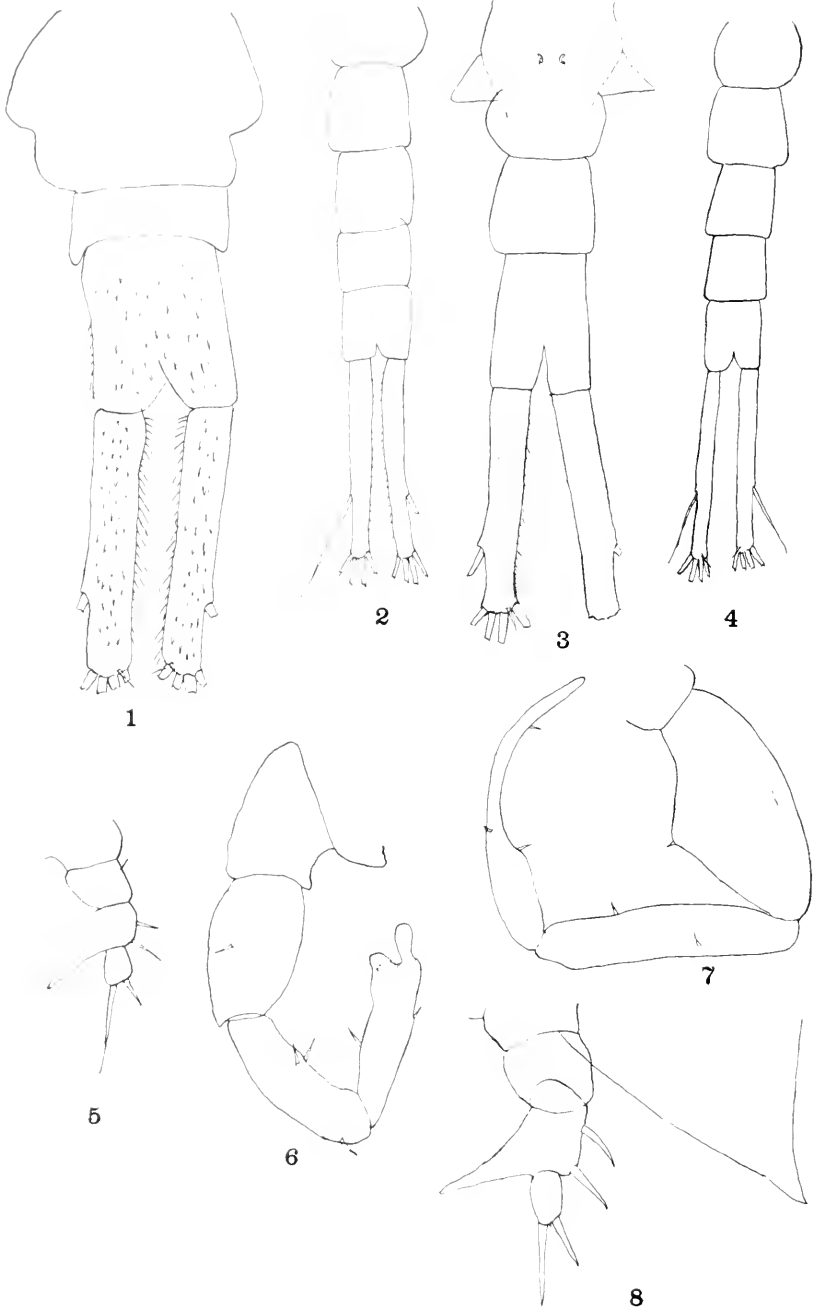
5. Mandible.



OSPHRANTICUM LABRONECTUM

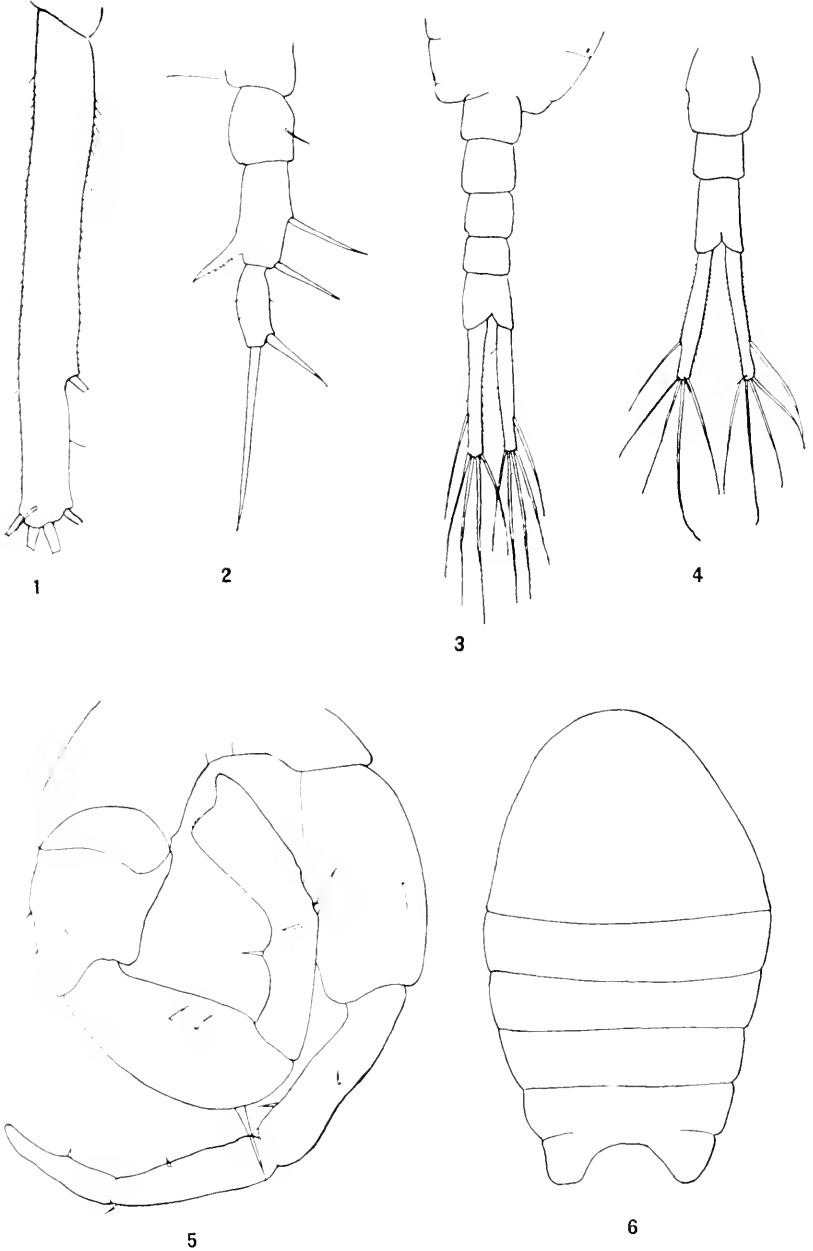
- 1. Fifth foot of female.
- 2. Fourth foot of female.
- 3. Fourth foot of male.

- 4. Abdomen of male.
- 5. Second antenna.



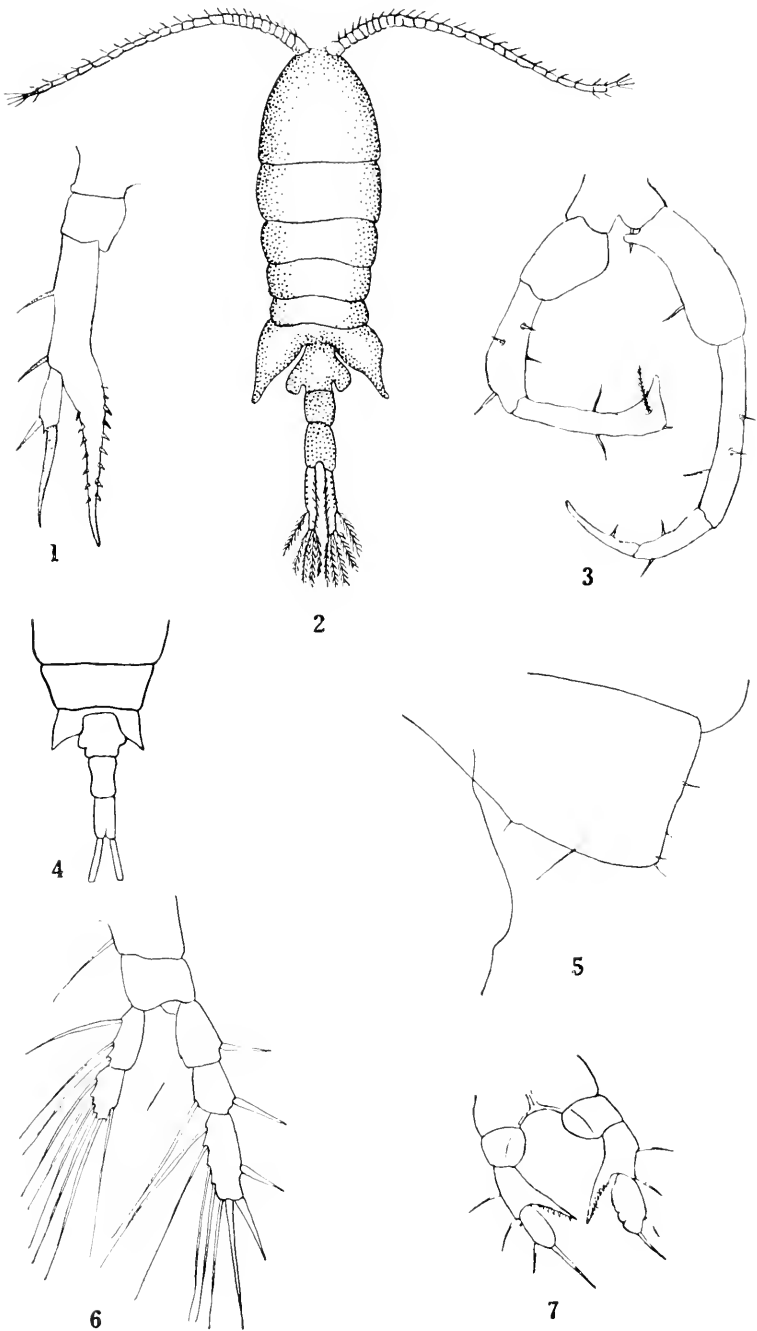
SPECIES OF EURYTEMORA

- 1-3. *Eurytemora affinis*: 1, Abdomen of female, dorsal side; 2, abdomen of male; 3, abdomen of female, ventral side; 4, abdomen of male; 5, fifth foot of female; 6, left fifth foot of male; 7, right fifth foot of male; 8, fifth foot of female, with wing of first thoracic segment.



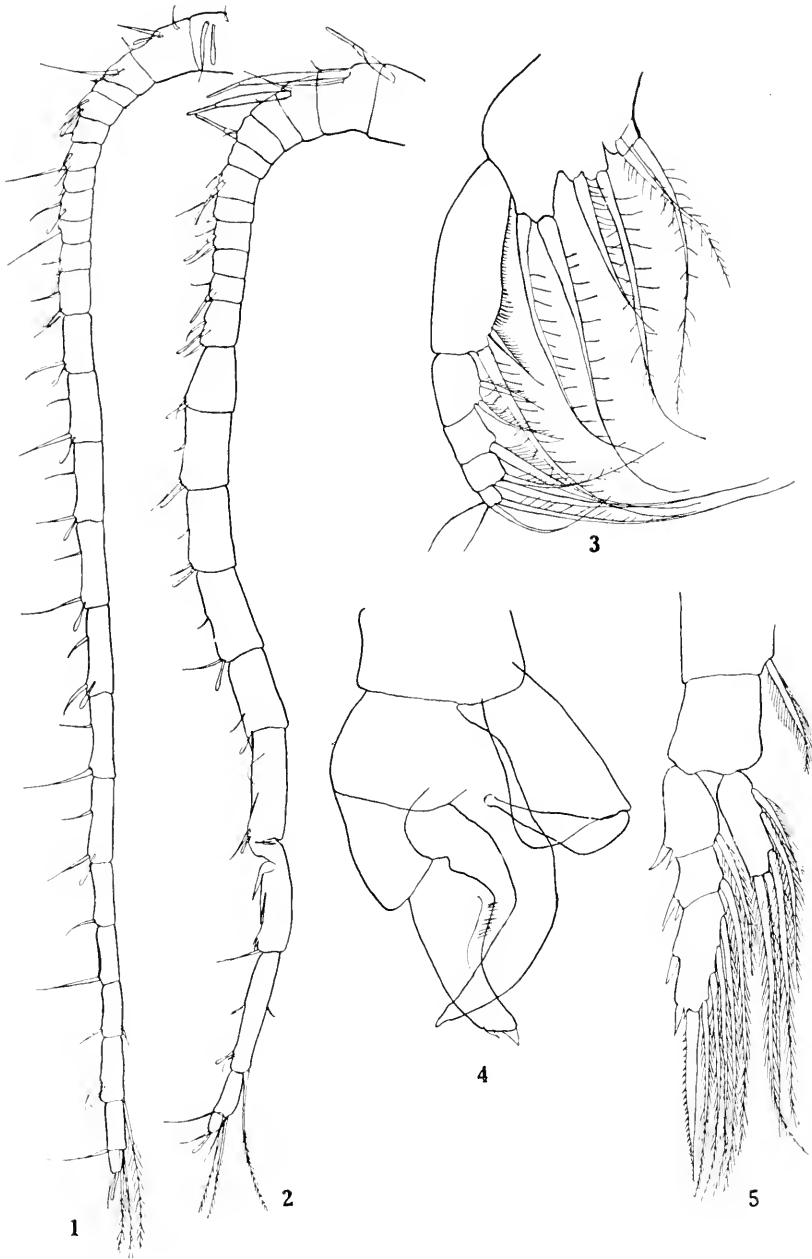
EURYTEMORA CANADENSIS

- 1. Furca of female.
- 2. Fifth foot of female.
- 3. Abdomen of male.
- 4. Abdomen of female.
- 5. Fifth feet of male.
- 6. Cephalothorax of female.



SPECIES OF EURYTEMORA

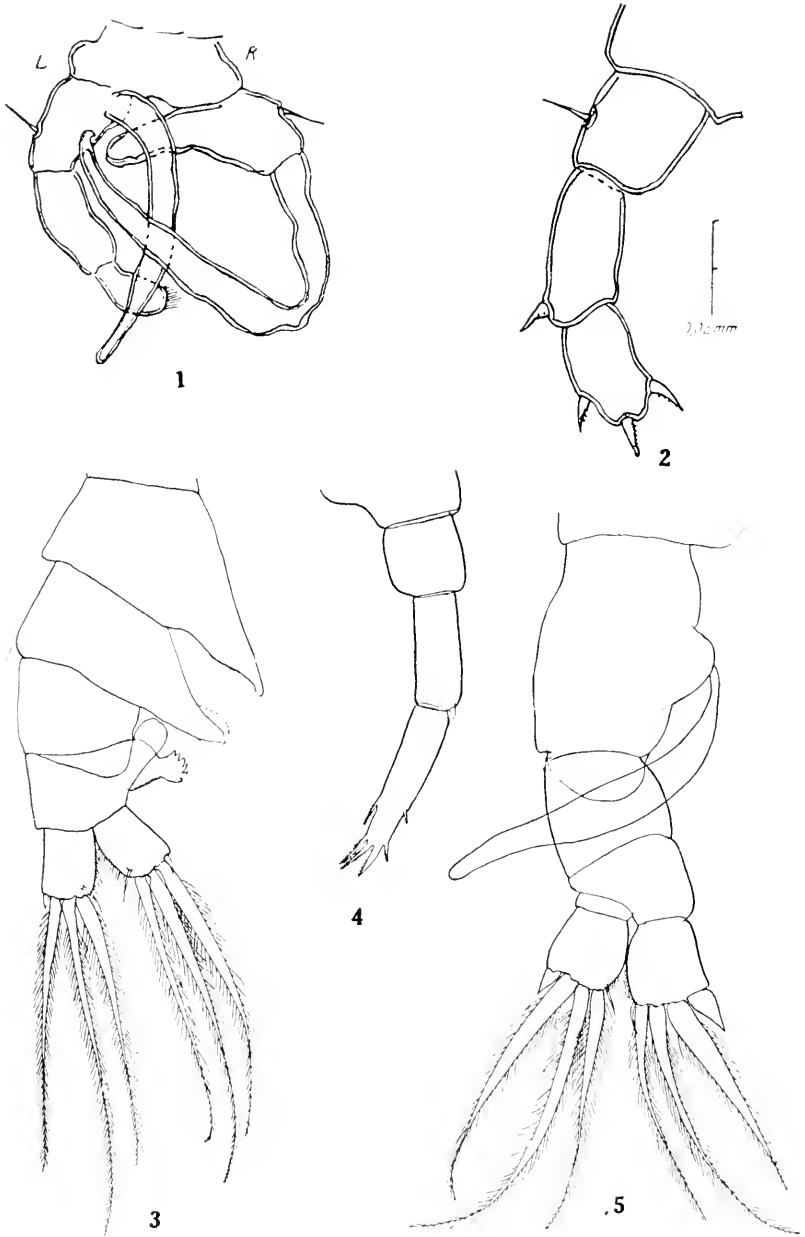
- 1-3. *Eurytemora herdmani*: 1, Fifth foot of female; 2, whole animal; 3, fifth foot of male. (After Thompson and Scott, 1898.)
 4, 7. *Eurytemora johanseni*: 4, Abdomen and last thoracic segment of female; 7, fifth foot of female. (After Willey, 1920.)
 5, 6. *Eurytemora canadensis*: 5, Angle of last segment of thorax of female; 6, fourth foot.



EPISCHURA LACUSTRIS

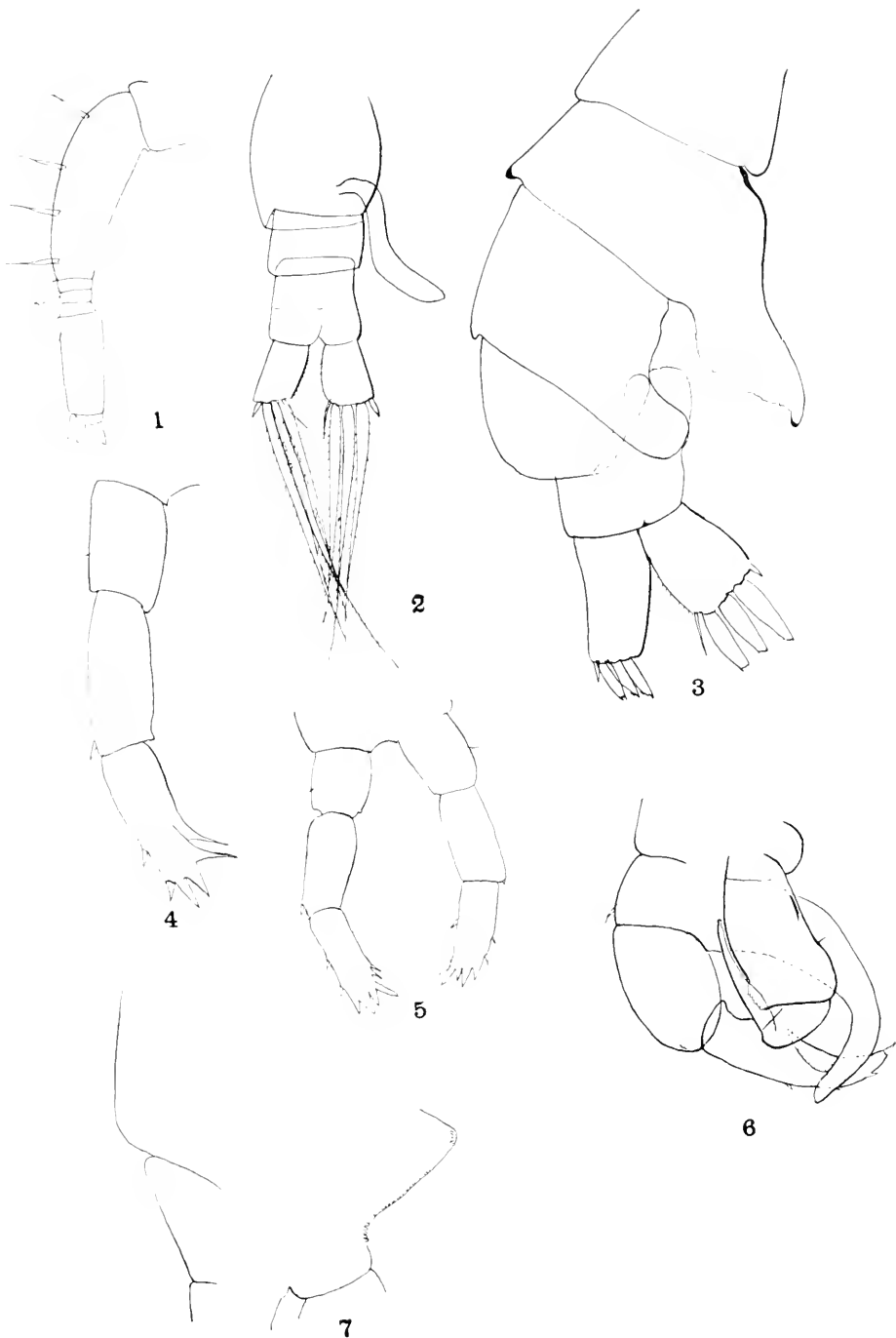
- 1. First antenna of female.
- 2. Right antenna of male.
- 3. Endopod of maxilliped.

- 4. Fifth feet of male.
- 5. Second swimming foot.



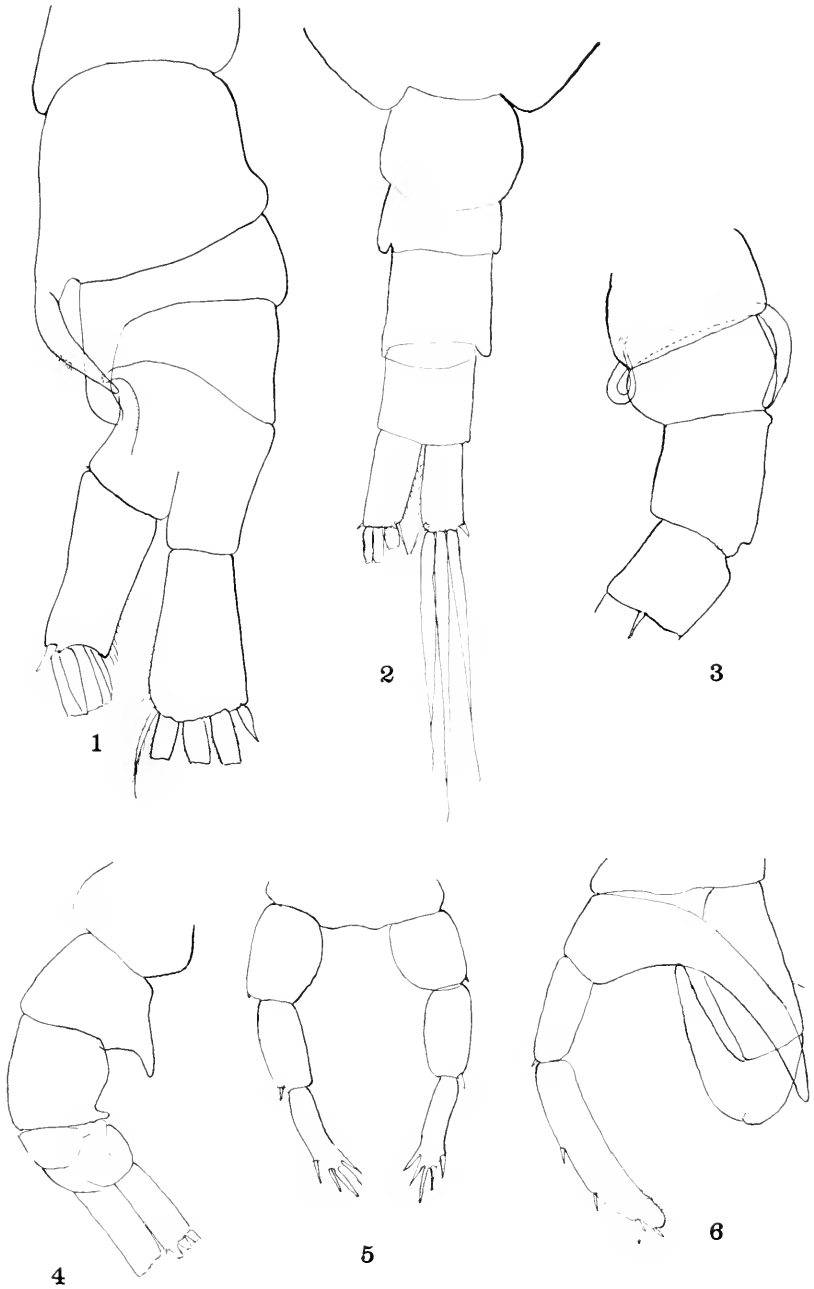
SPECIES OF EPISCHURA

1, 2. *Epischnura chankensis*: 1, Fifth feet of male; 2, fifth feet of female. (After Rylov, 1928.)
3-5. *Epischnura lacustris*: 3, Abdomen of male; 4, fifth feet of female; 5, abdomen of female.



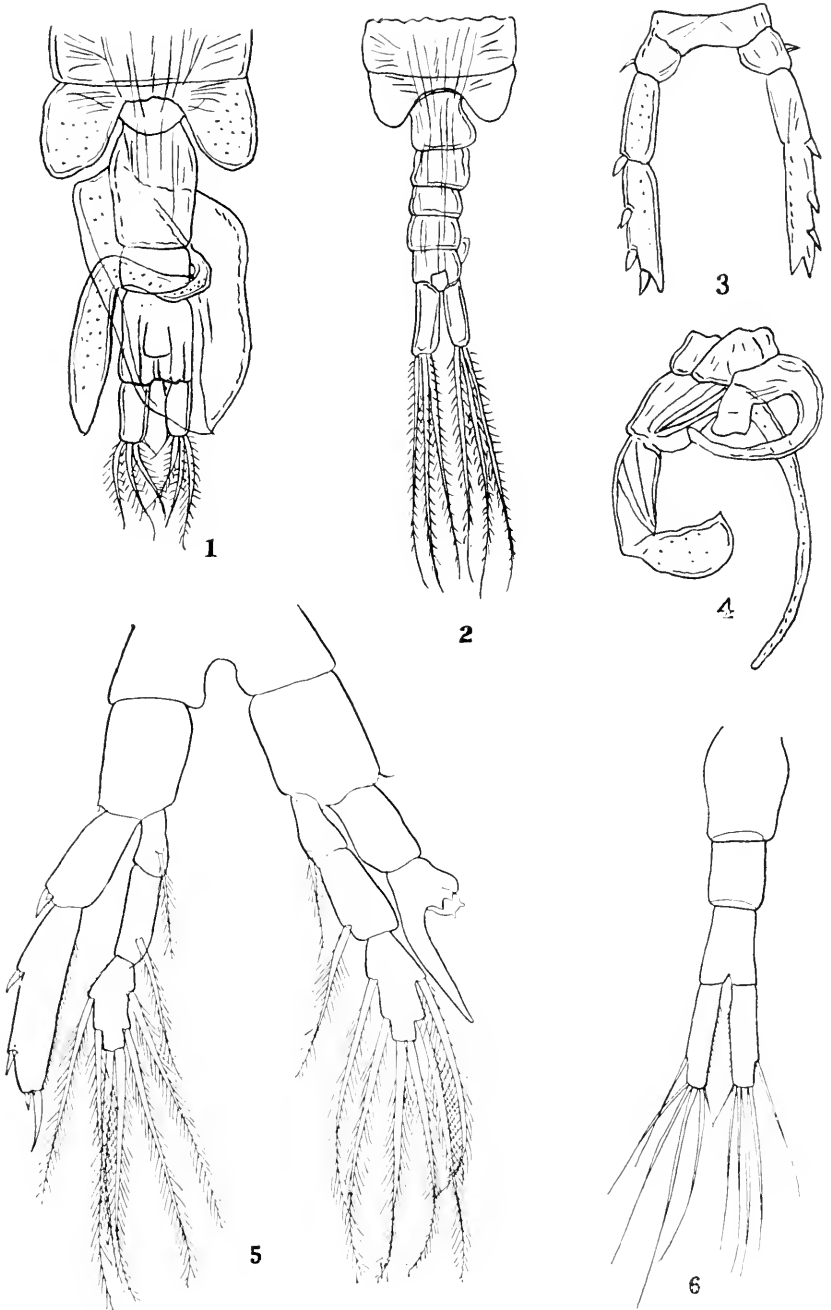
SPECIES OF EPISCHURA

1. *Epischura lacustris*: Exopod of second antenna.
 2-7. *Epischura nevadensis*: 2, Abdomen of female; 3, abdomen of male; 4, fifth foot of female; 5, fifth feet of female from Alaska; 6, fifth feet of male; 7, ventral process of fifth abdominal segment of male.



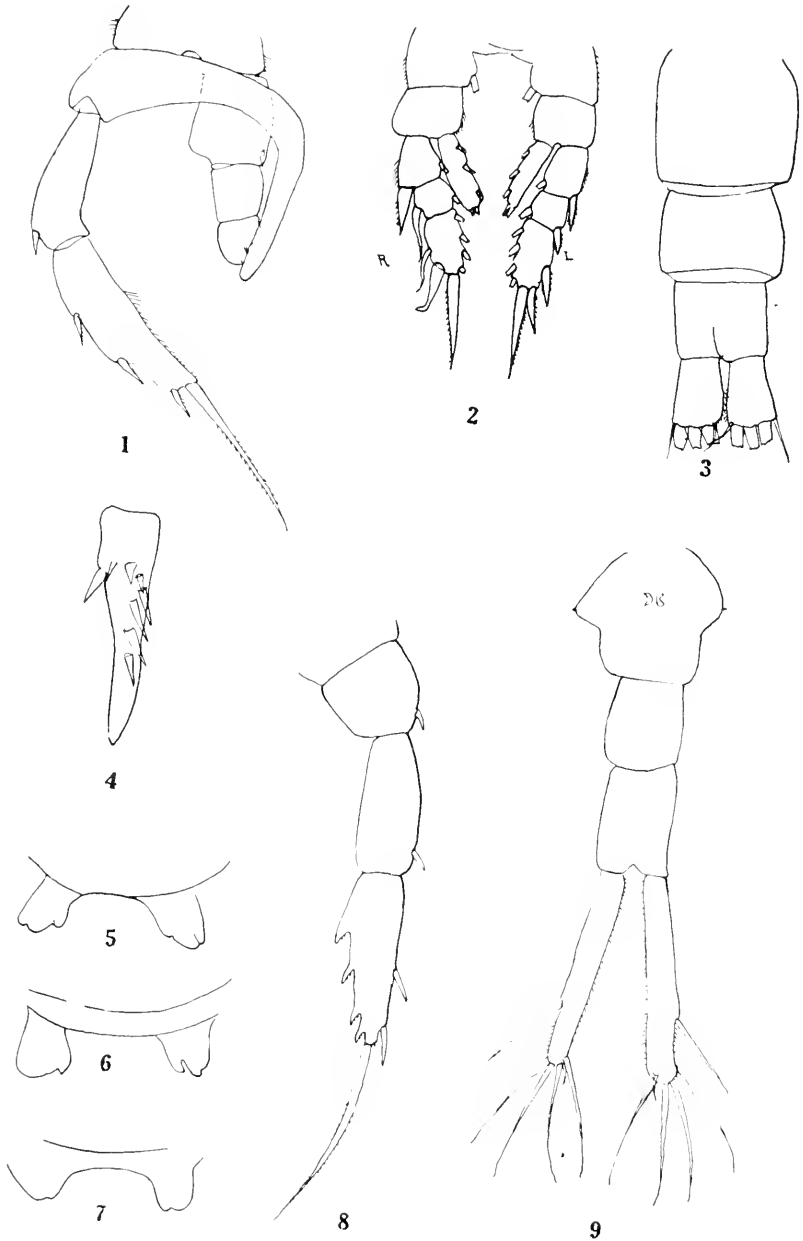
SPECIES OF EPISCHURA

1. *Epischura neradensis*: Ventral side of male abdomen.
 2-6. *Epischura nordenskiöldi*: 2, 3, Abdomen of female; 4, abdomen of male; 5, fifth feet of female; 6, fifth feet of male.



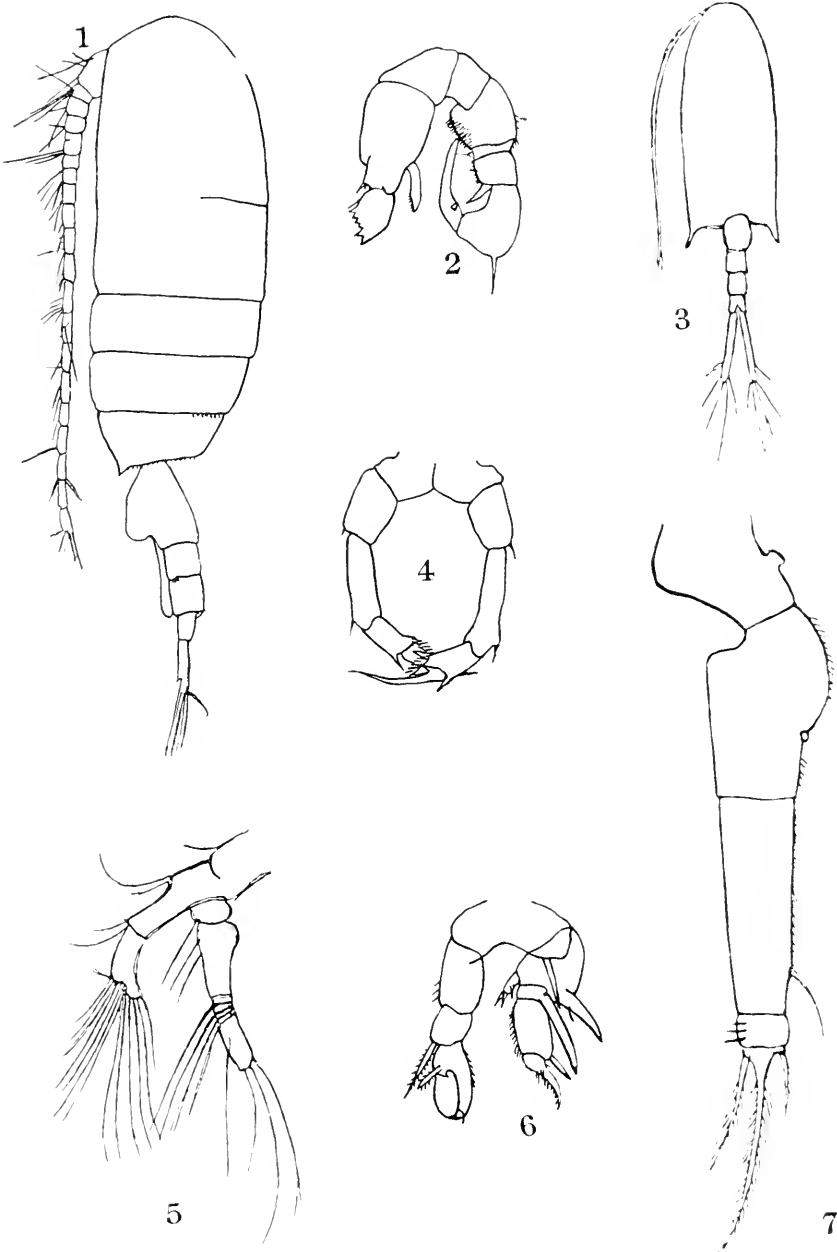
SPECIES OF EPISCHURA AND LIMNOCALANUS

- 1-4. *Epischura baikalensis*: 1, Abdomen of female with spermatophore; 2, abdomen of male; 3, fifth feet of female; 4, fifth feet of male. (After Sars.)
5. *Limnocalanus macrurus*: Fifth feet of male.
6. *Limnocalanus johauseni*: Abdomen of female.



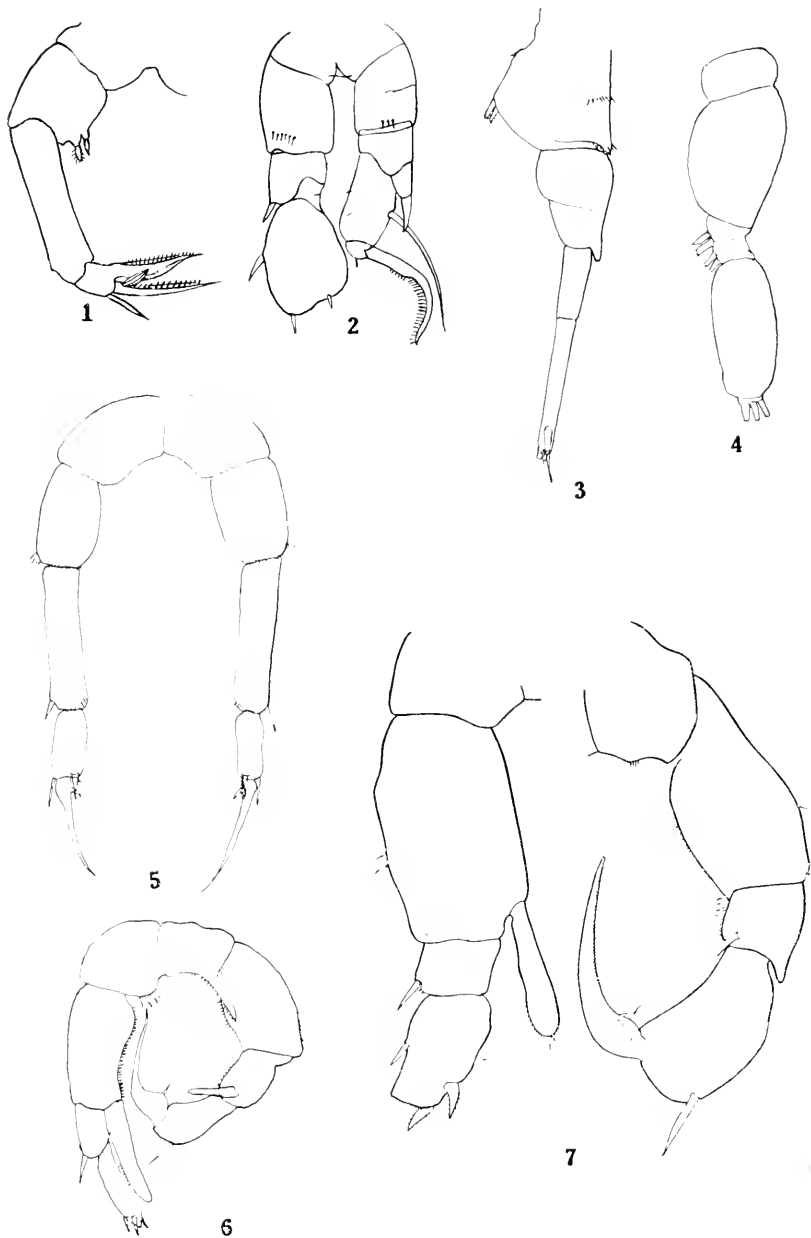
SPECIES OF HETEROCOPE AND EURYTEMORA

- 1-8. *Heterocope septentrionalis*: 1, Fifth feet of male; 2, second feet of male; 3, abdomen of female; 4, spine of first segment of right exopod of second foot of male; 5-7, appendages of genital segment of female; 8, fifth foot of female.
 9. *Eurytemora hirundoides*: Abdomen of female.



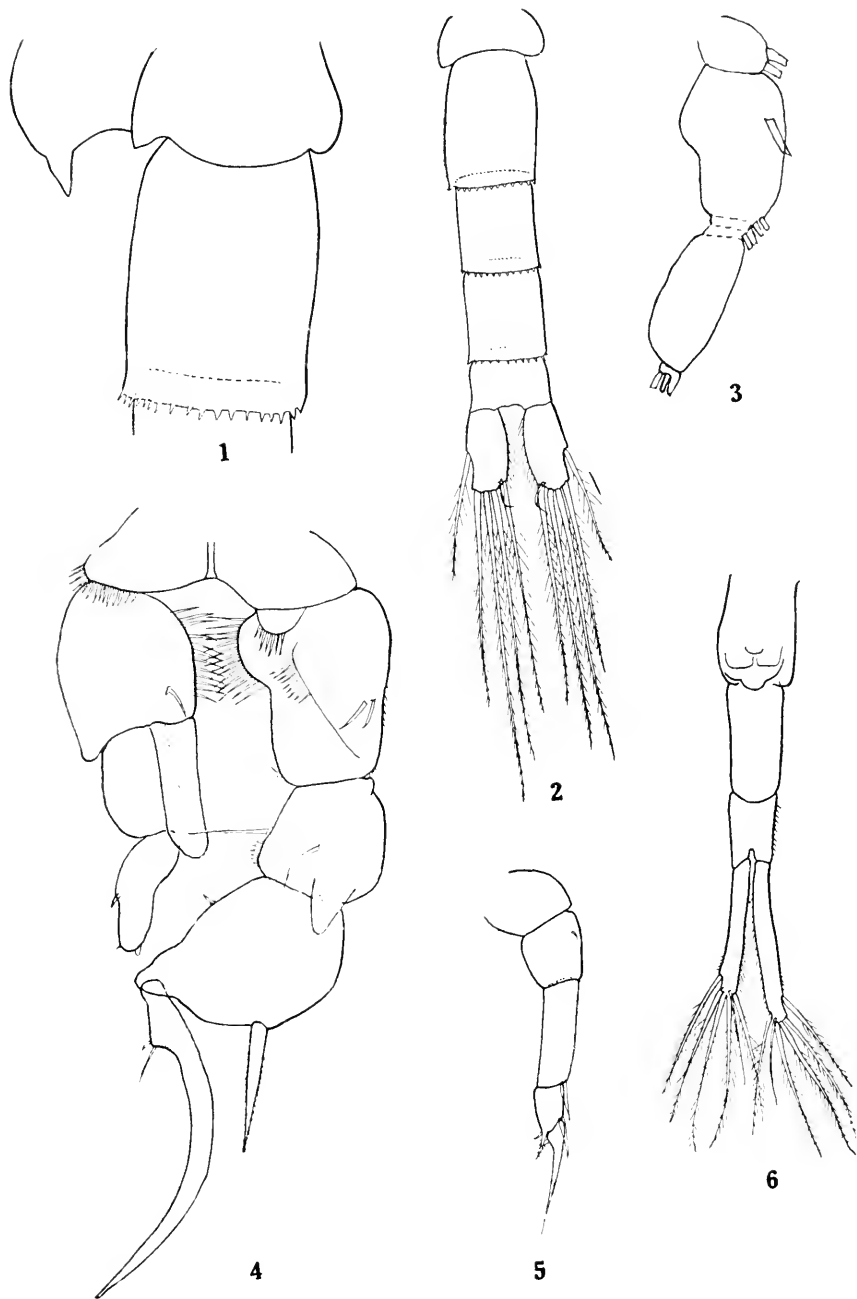
SPECIES OF PSEUDODIAPATOMUS

1, 2, 4 *Pseudodiaptomus acutus*: 1, Whole animal; 2, Fifth feet of male; 4, Fifth feet of female. (After Dahl, 1894.)
 3, 5-7. *Pseudodiaptomus aurivilli*: 3, Whole animal (after Cleve, 1901); 5, second antenna (after Cleve, 1901); 6, fifth feet of female (after Thompson and Scott, 1903); 7, fifth feet of female (after Thompson and Scott, 1903).



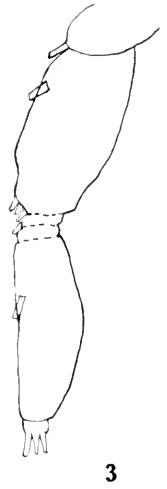
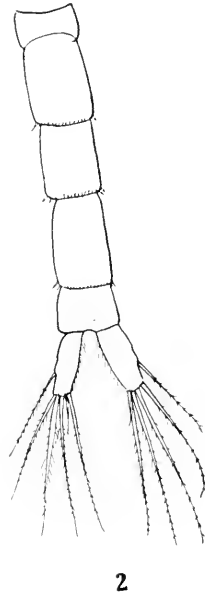
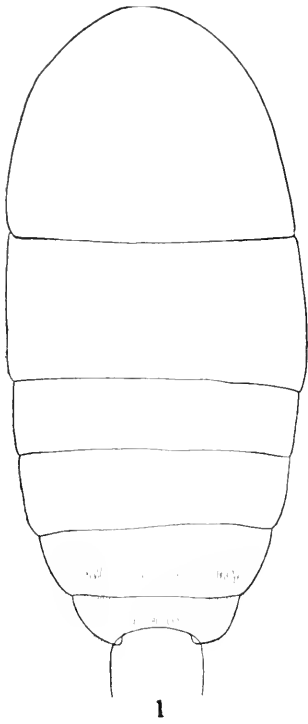
SPECIES OF PSEUDODIAPTOMUS

- 1, 2. *Pseudodiaptomus clevei*: 1, Fifth foot of female; 2, fifth foot of male. (After Scott, 1909.)
 3-6. *Pseudodiaptomus coronatus*: 3, Abdomen of female; 4, exopod of second antenna; 5, fifth feet of female; 6, fifth feet of male.
 7. *Pseudodiaptomus cristobalensis*: Fifth feet of male.



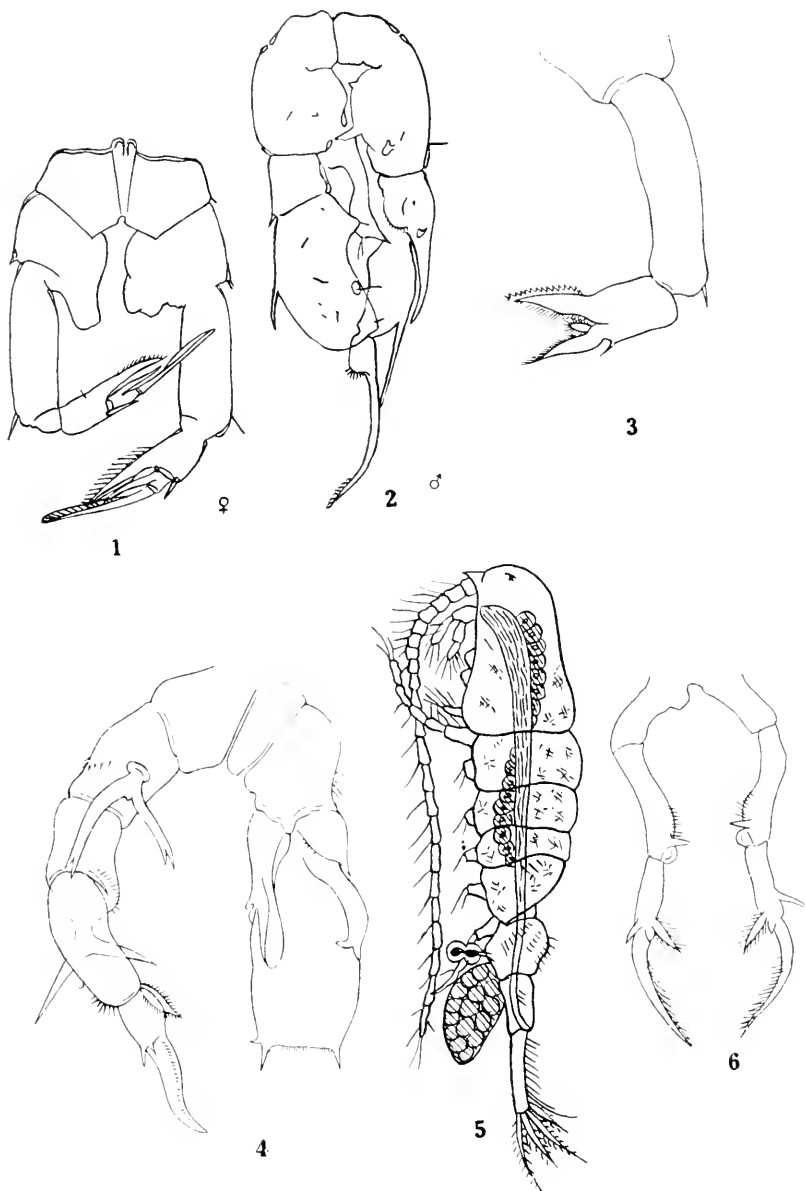
SPECIES OF PSEUDODIAPTOMUS

- 1-3. *Pseudodiaptomus cristobalensis*: 1, Last thoracic and first abdominal segments of male;
 2, abdomen of male; 3, exopod of second antenna.
 4-6. *Pseudodiaptomus cutchensis*: 4, Fifth feet of male; 5, fifth foot of female; 6, abdomen of female.



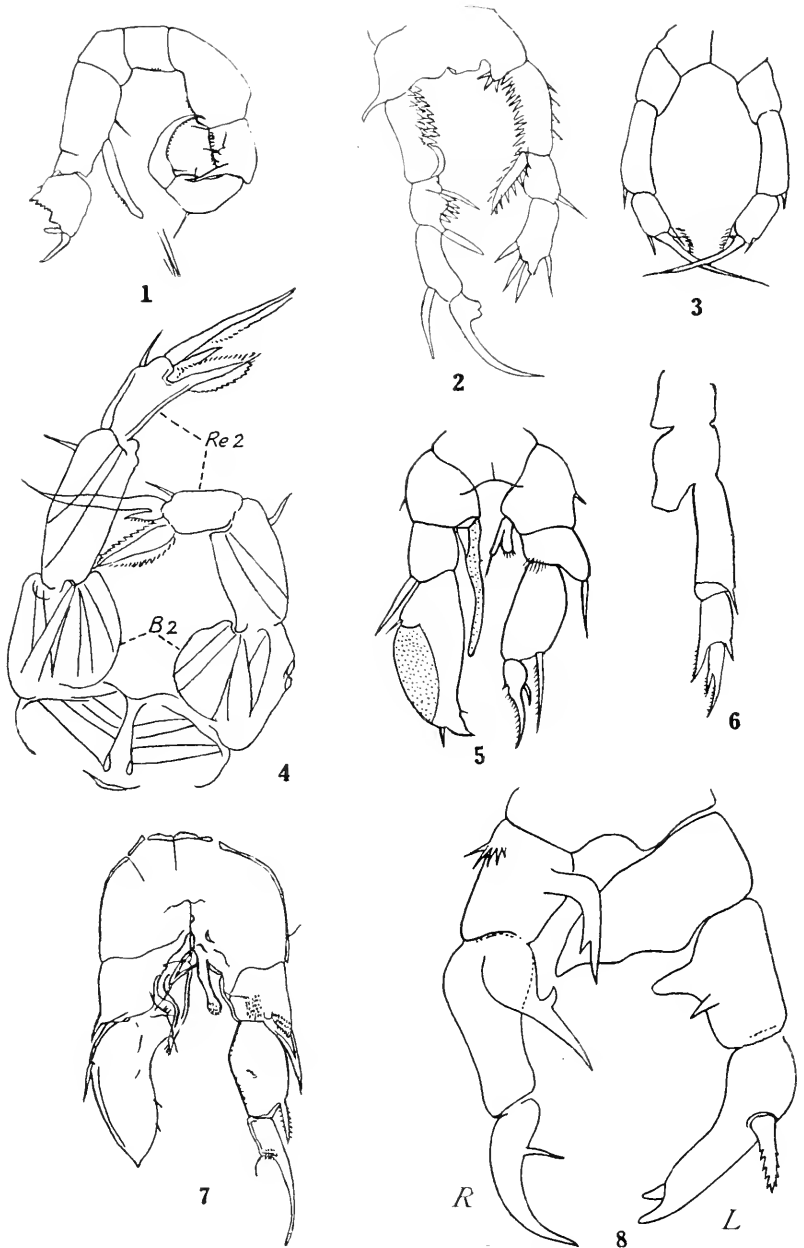
SPECIES OF PSEUDODIPTOMUS

1-3. *Pseudodiptomus culbrencis*: 1, Cephalothorax of female; 2, abdomen of male; 3, exopod of second antenna.
4-5. *Pseudodiptomus gracilis*: 4, Fifth foot of female; 5, fifth foot of male; 6, abdomen of female.



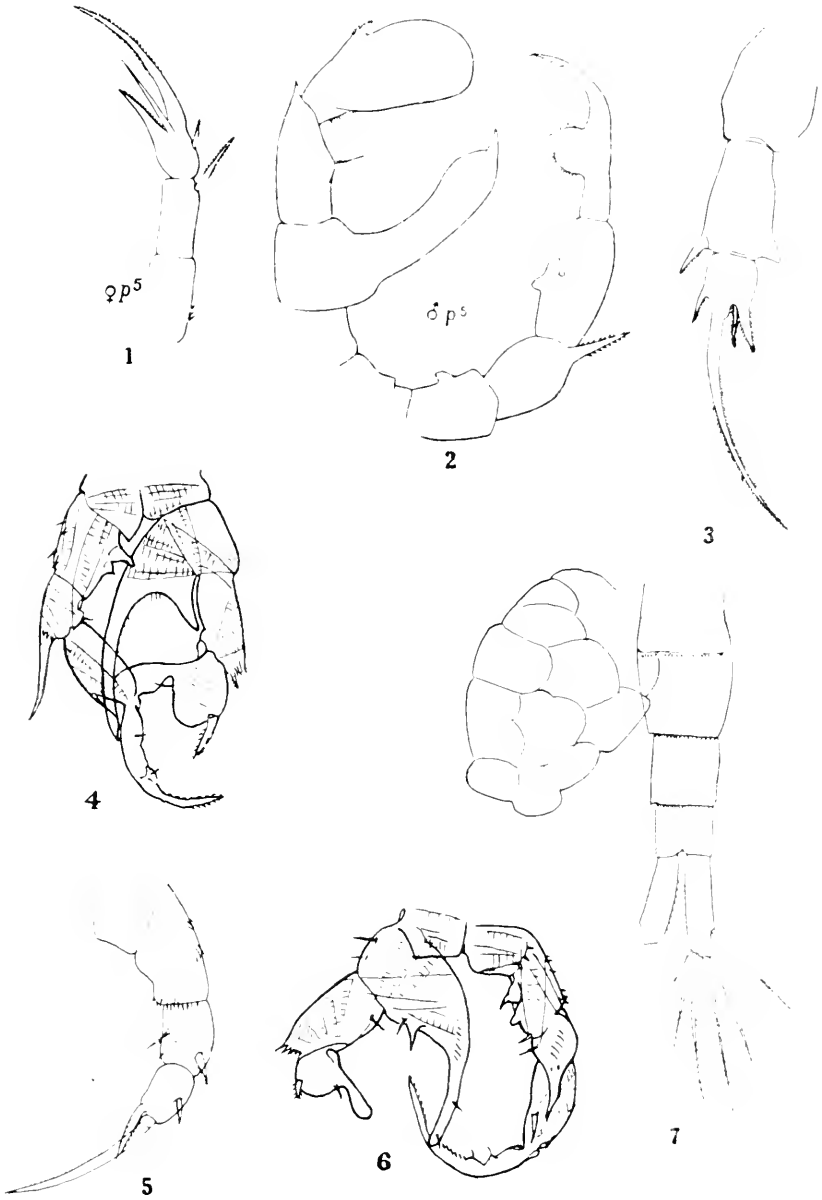
SPECIES OF PSEUDODIAPTOMUS

- 1, 2. *Pseudodiaptomus hessii*: 1, Fifth feet of female; 2, fifth feet of male. (After Mrázek, 1894.)
 3, 4. *Pseudodiaptomus hickmani*: 3, Fifth foot of female; 4, fifth feet of male. (After Sewell, 1912.)
 5, 6. *Pseudodiaptomus plagicus*: 5, Whole animal, female; 6, fifth feet of female. (After Herrick, 1887.)



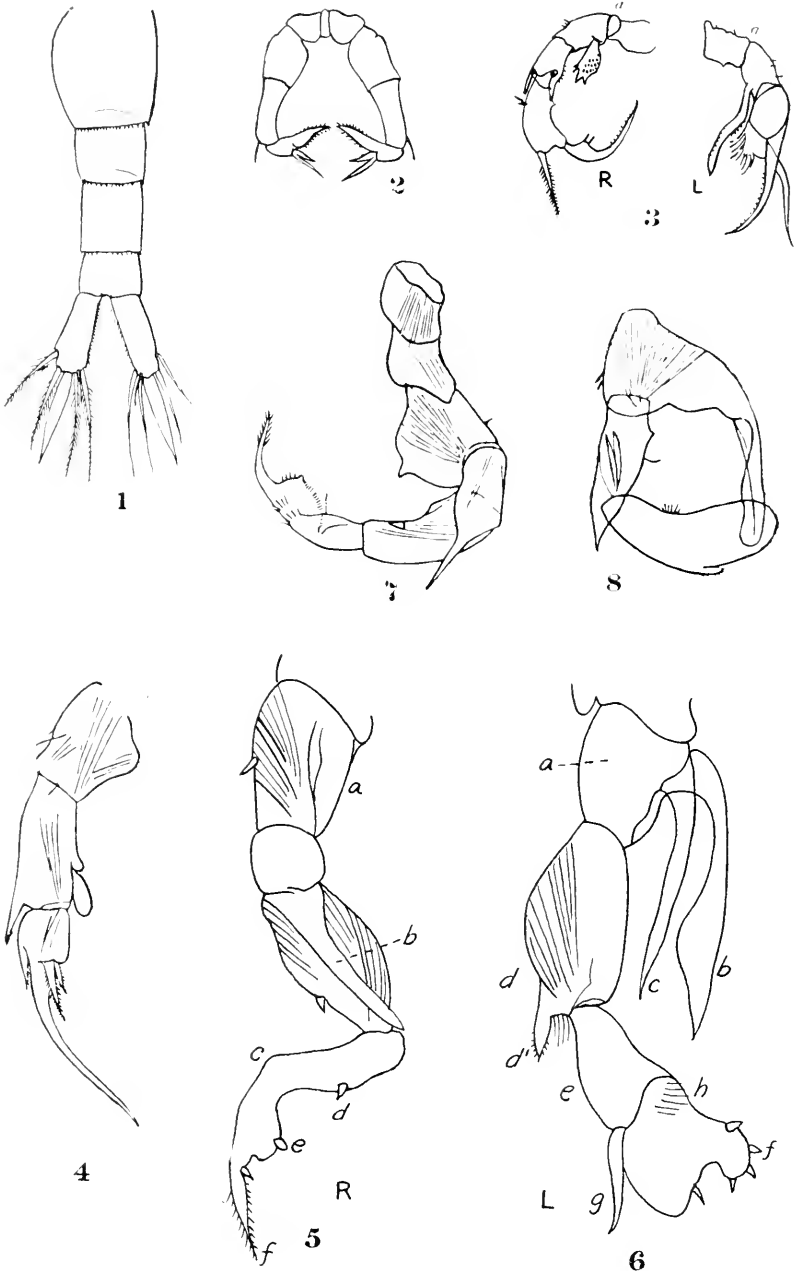
SPECIES OF PSEUDODIPTOMUS AND SCHMACKERIA

- 1, 3. *Pseudodiptomus richardi*: 1, Fifth feet of male; 3, fifth feet of female. (After Dahl, 1894.)
 2. *Pseudodiptomus pelagicus*: Fifth feet of male. (After Herrick, 1887.)
 4, 5. *Pseudodiptomus salinus*: 4, Fifth feet of female (after Giesbrecht, 1896); 5, fifth feet of male (after Thompson and Scott, 1903.)
 6, 7. *Pseudodiptomus stuhlmanni*: 6, Fifth foot of female; 7, fifth feet of male. (After Poppe and Mrázek, 1895.)
 8. *Schmackeria annandali*: Fifth feet of male. (After Sewell, 1919.)



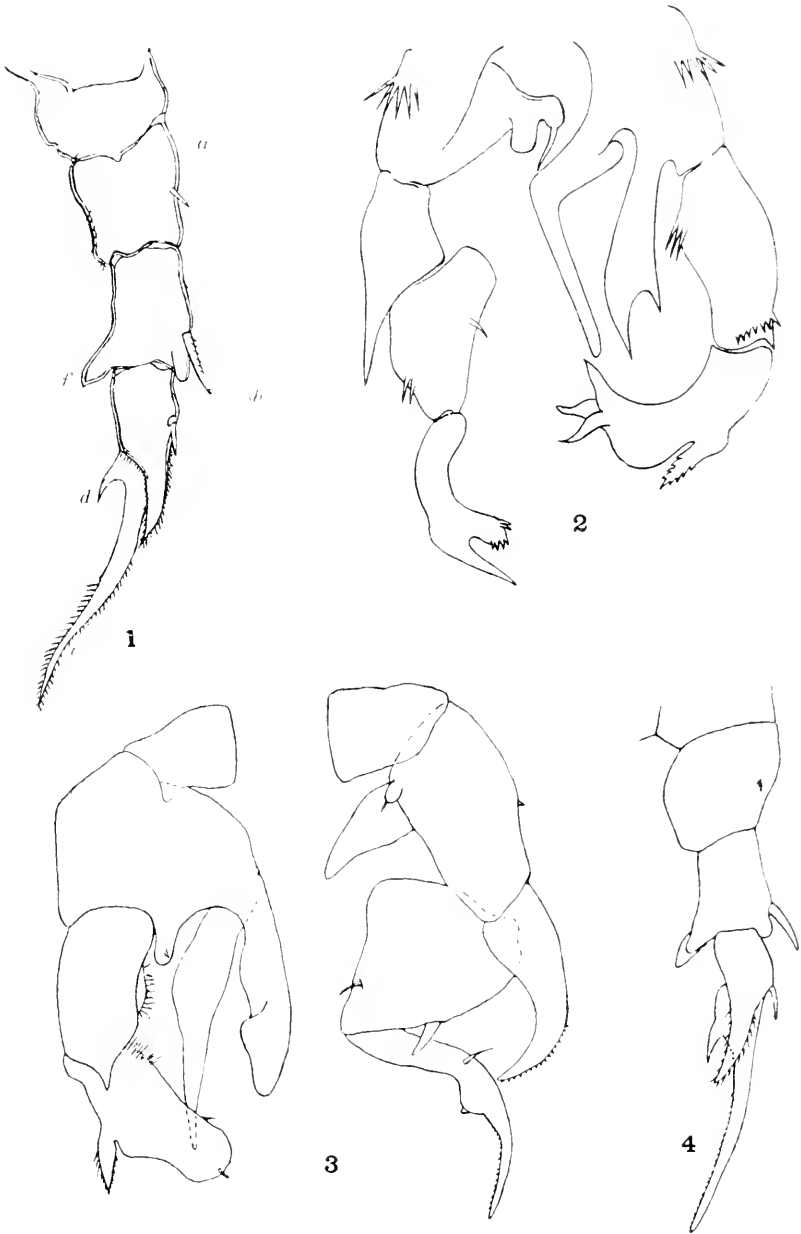
SPECIES OF SCHMACKERIA

1. *Schmackeria univulvata*: Fifth foot of female. (After Sewell, 1921.)
 2, 3. *Schmackeria binghami*: 2. Fifth feet of male (after Sewell, 1921); 3. fifth foot of female (after Sewell, 1921).
 4, 5, 7. *Schmackeria forbesi*: 4. Fifth feet of male (after Burckhardt, 1913); 5. fifth foot of female; 7. abdomen of female.
 6. *Schmackeria inopinus*: Fifth feet of male. (After Burckhardt, 1913.)



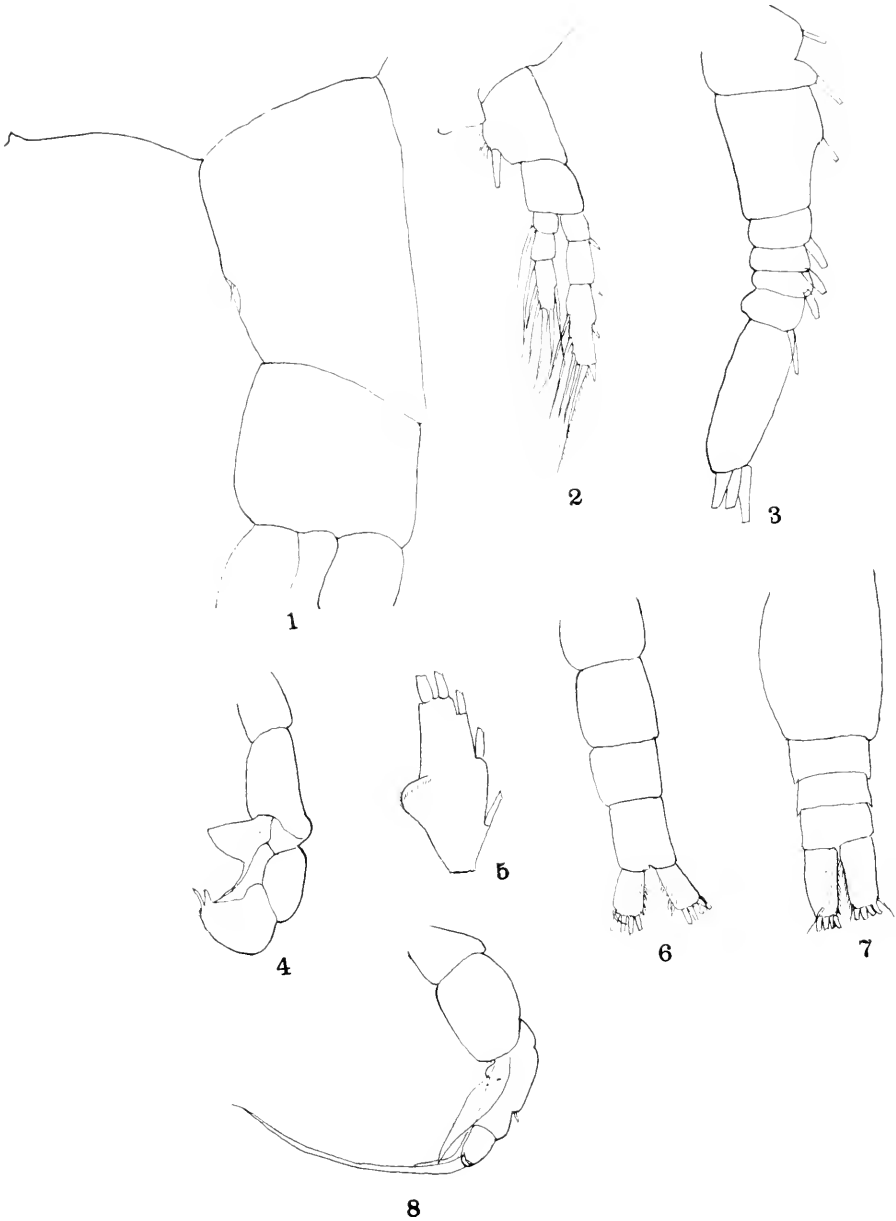
SPECIES OF SCHMACKERIA

1. *Schmackeria inopinus*: Abdomen of female.
 2, 3. *Schmackeria serricaudatus*: 2, Fifth feet of female; 3, fifth feet of male. (After T. Scott, 1893.)
 4, 7, 8. *Schmackeria lobipes*: 4, Fifth foot of female; 7, right fifth foot of male; 8, left fifth foot of male. (After Gurney, 1907.)
 5, 6. *Schmackeria poppi*: 5, Right fifth foot of male; 6, left fifth foot of male. (After Stingelin, 1900.)



SPECIES OF SCHMACKERIA

1. *Schmackeria poppei*: Fifth foot of female. (After Stingelin, 1900.)
2. *Schmackeria tollingeri*: Fifth feet of male. (After Sewell, 1919.)
- 3, 4. *Schmackeria smithi*: 3, Fifth feet of male; 4, fifth foot of female. (After Wright, 1928.)



SENECELLA CALANOIDES

- 1. Basal segments of fourth foot of male.
- 2. Fourth foot of female.
- 3. Exopod of second antenna.
- 4. Left fifth foot of male.
- 5. Endopod of first foot.
- 6. Abdomen of male.
- 7. Abdomen of female.
- 8. Right fifth foot of male.

WEST AFRICAN SNAILS OF THE FAMILY ACHATINIDAE IN THE UNITED STATES NATIONAL MUSEUM

By HENRY A. PILSBRY

Academy of Natural Sciences of Philadelphia

The land mollusks herein described were found in the course of a review of West African mollusks in the United States National Museum. The most interesting item perhaps is the snail described as *Achatina turbinata* Lea, the type specimen of which turns out to be a species of the genus *Pseudotrochus*. Though described over 90 years ago, it has not been illustrated hitherto, and never subsequently recognized. Later authors supposed Lea's shell to be a *Limicolaria*, and a very different species of that genus has been mistaken for it. Rolla P. Currie rediscovered this long-forgotten snail at Mount Coffee, Liberia.

Other snails now described were taken by the Collins-Garner French Congo expedition of 1918 in the Gaboon Colony, and by Rolla P. Currie, of the United States Bureau of Entomology, in Liberia. Mr. Currie, then aid in the division of insects of the National Museum, accompanied Dr. O. F. Cook, the well-known authority on Myriapoda, who visited Liberia as agent of the New York Colonization Society in the spring of 1897. He made valuable collections at Mount Coffee, on the St. Paul River about 7 miles inland from the Muhlenburg Mission and 25 to 30 miles from Monrovia.

Genus ARCHACHATINA Albers

ARCHACHATINA GABOONENSIS, new species

PLATE 1, FIGURES 3, 4

Type.—U.S.N.M. No. 336168, collected by Aschemeier, Collins-Garner French Congo expedition, at Agouma, Rem Nkami, Gaboon Colony, French Congo.

Description.—The shell is solid, oblong-conic, with broad, rounded summit. Surface glossy; bright apricot-yellow with bold stripes of chestnut-brown, which on the last whorl are widest in the middle, irregular or weakly zigzag, and taper or are forked near the suture; on the penultimate whorl they are generally more zigzag or oblique. The summit is dull reddish. Sculpture of fine, irregular striae cut

into minute granules by impressed spiral lines, after the smooth (worn) initial whorl; on the penultimate whorl this sculpture becomes weaker, and on the last whorl it is only faintly visible under the lens as spiral series of long, weak granules in some places. There is none of the microscopic granulation which covers the surface of *A. marginata*. In the last two and a half whorls the suture is rather broadly marginate, the margin more or less plicatulate. The ovate aperture is bluish within. Outer and basal margins of peristome acute, very slightly expanded. Columella white; much less concave than in *A. marginata*.

Length, 94 mm; diameter, 52.7 mm; aperture, 55 mm long; $6\frac{2}{3}$ whorls.

Remarks.—This species is less inflated than *A. marginata*, without the minute granulation of the last whorl so characteristic of that species, and with more sharply contrasting dark streaks, which cover less of the surface. The columella, while somewhat variable as usual in achatinas, is less twisted spirally. It has some superficial resemblance to *Achatina weynsi* Dautz.

Six specimens were collected at the type locality. A much discolored egg, which fell out of one of them, has a minutely roughened surface and measures 12 by 16 mm.

Agouma,¹ where these shells were taken, is about 100 kilometers inland from Fernand Vas and the same distance south of Lambarene. It is somewhat higher than the latter, between 200 and 300 meters elevation, in forest, according to the French colonial atlas.

ARCHACHATINA GABOONENSIS LAMBARENENSIS, new variety

PLATE 2, FIGURE 3

A much larger form or race from Lambarene, on the Ogowe (Ogooue) River, Gaboon Colony, is in the collection of the Academy of Natural Sciences of Philadelphia, No. 159294, collected by Mrs. L. Russell. Length, 120 mm; diameter, 70 mm; $6\frac{3}{4}$ whorls. Other characters as in the type lot.

ARCHACHATINA SPECTACULUM, new species

PLATE 2, FIGURE 4

Specimens.—Type: U.S.N.M. No. 406386, received from J. Wilson from West Africa. Paratype: No. 20220, "Gambia," Totten.

Description.—The solid, ovate-conic shell is between olive-ocher and honey-yellow, with straight, widely spaced, brown and light brownish-olive streaks, the spire whitish to pale brown with darker brown irregular streaks; apex whitish. The whorls are rather

¹ "Ogouma" on the labels, but I presume Agouma was intended. I do not know the significance of "Rem Nkami."

weakly convex, less so than in *A. purpurea* or *A. ventricosa*. Suture with a rather weakly defined margination. Surface closely granulose, the granules in spiral lines and superposed on the irregular axial wrinkles, a little weaker below the periphery; on the early whorls similar to those of *A. purpurea*. The aperture is ovate, pale vinaceous-pink within, somewhat darker within the lip edge. Columella and parietal callus vinaceous, with a darker outer edge. Measurements are as follows:

Measurement	Type	Paratype
Length.....mm..	105	99
Diameter.....mm..	68.5	61.7
Length of aperture.....mm..	72.2	66.2
Number of whorls.....	7	6½

Remarks.—The shape is about that of *A. rhodostoma* (Philippi), but it differs from that by the well-developed granulation of the last whorl, as in *A. purpurea* and *A. ventricosa*, and by the longer aperture, over 68 per cent of the length of shell, while in *rhodostoma* the aperture occupies about 57 per cent and in *A. rhodostoma splendida* about 59.6 per cent. In *A. spectaculum* the aperture is distinctly narrower than in *A. rhodostoma*, *purpurea*, or *ventricosa*. The parietal callus has a dusky edge, not a lighter edge as in *A. rhodostoma*, in this respect resembling *A. purpurea*. The interior in *A. spectaculum* is decidedly paler than in *A. purpurea* and *A. ventricosa*, and the whorls are much less convex than in those species.

This species differs so much from others of the *purpurea* group known to this time² that it seems best to call attention to it, even though the locality is unknown. Its relations are with the species of that Liberian group, as it has the sculpture of *A. ventricosa* and much the shape of *A. rhodostoma*.

Genus PSEUDOTROCHUS H. and A. Adams

PSEUDOTROCHUS TURBINATUS (Lea)

PLATE 1, FIGURES 1, 2

Achatina turbinata LEA. Proc. Amer. Philos. Soc., vol. 2, p. 31, May 7, 1841.

Specimens.—Type: U.S.N.M. No. 116706, collected by Doctor Blanding in Liberia. No. 151005, collected by R. P. Currie at Mount Coffee, Liberia.

Description.—The shell is thin, ovate-conic, the outlines only slightly contracted below the summit. The last whorl is opaque white with widely spaced, irregular dark streaks and scattered spots, which are liver-brown on the back, chestnut on the front; the penultimate

² Man. Conch., vol. 17, pp. 113–116, 1905.

whorl with still lighter streaks on a grayish-white ground, earlier whorls uniform whitish. The first whorl is smooth, the rest with very fine, irregular, oblique striae decussated by closely engraved spiral lines; these are somewhat weaker on the last whorl, which is distinctly malleate on the back. The whorls are only moderately convex, the last angular at the periphery in front, the angle disappearing on the back. Suture shallow, narrowly marginate, and minutely, not very strongly, crenulate. The ovate, oblique aperture shows the external color markings. Lip thin, white, the basal margin rather deeply concave. Columella subvertical, faintly brownish, obliquely truncate anteriorly.

Length, 33 mm; diameter, 19.4 mm; aperture, 18 mm long; $5\frac{2}{3}$ whorls.

Remarks.—Doctor Lea's first description of this species was from the specimen illustrated in Plate 1, Figures 1, 2, and redescribed above. He subsequently thought that this shell represented an immature stage of a much larger form, which he had from the same place and collector, and his second description³ was from this larger form, which differs from the original type in size, shape, color, and number of whorls. Copies of Lea's two descriptions have been given in Manual of Conchology, vol. 16, p. 253, 1904. His opinion that the two shells were young and adult stages of one species was certainly erroneous. They are both adult and belong to appreciably different groups of species. I am describing Lea's second conception of *A. turbinata* as *Pseudotrochus leai*.

Lea did not figure his species, and his comparison with "*Achatina*" *flammata* led later authors to refer it to the genus *Limicolaria*.

Reeve's *Bulimus turbinatus*, which he doubtfully identified with Lea's species, is an entirely different West African *Limicolaria*.

P. turbinatus is very closely related to *P. mucidus* (Gould), described some years later, but *turbinatus* differs by its sparser markings and the subangular last whorl. Further collections are needed to determine whether there is intergradation; the small series in the collections of the Academy of Natural Sciences of Philadelphia and the National Museum do not show any intermediate stages.

PSEUDOTROCHUS LEAI, new species

PLATE 1, FIGURES 6, 7

Achatina turbinata LEA, Trans. Amer. Philos. Soc., vol. 9, p. 2, Apr. 5, 1844; repeated in Observations on the genus *Unio*, vol. 4, p. 2, 1848. (Not *A. turbinata* Lea, 1841.)

Type.—U.S.N.M. No. 406385, collected by Doctor Blanding in Liberia and received with the Lea collection.

³ Trans. Amer. Philos. Soc., vol. 9, p. 2, 1844.

Description.—The shell is moderately solid, oblong-conic, with conspicuously mammillate summit. Last whorl honey-yellow with some chestnut suffusion and numerous oblique chestnut lines of varying intensity, also a few scattered dots. Penultimate whorl with broad, ill-defined, whitish and chestnut-brown stripes and some opaque white spots in the upper half; earlier whorls whitish. Surface shining, smoothish, with fine wrinkles of growth and a faint, shallow, and close microscopic spiral striation, only perceptible in some places. There are two conspicuous growth rests on the last whorl. The whorls are rather weakly convex, the last rounded peripherally, though the shell is apparently angular when young, as a blunt angulation of the penultimate whorl is exposed above the suture. Suture margined, the margin regularly crenulated. The aperture is moderately oblique, ovate, whitish with dark streaks within. Columella white, vertical, nearly straight, curving into the basal margin, not truncate.

Length, 69.2 mm; diameter, 32.7 mm; aperture, 31.5 mm long; 8 whorls.

Remarks.—This species has much in common with *P. torridus* (Gould), but the narrower contour and the difference in color pattern serve to differentiate them in the series now available.

PSEUDOTROCHUS COFFEAMONTIS, new species

PLATE 1, FIGURE 5

Type.—U.S.N.M. No. 151004, collected by Rolla P. Currie at Mount Coffee, Liberia, 1897.

Description.—The shell is thin, ovate, with mammillate summit, honey-yellow to old gold in color, with some narrow, inconspicuous, whitish streaks on the spire, the upper whorls of which are pale isabella color. Surface mat with slightly glossy patches where worn, the apex glossy. Under the lens fine engraved spiral lines are seen on postembryonic whorls of the spire and the upper part of the last whorl. The microscope shows a clothlike texture of criss-cross scratches, especially well developed in the middle and basal parts of the last whorl and more or less obsolete in the upper part. The whorls are feebly convex, the last rounded peripherally. Suture superficial, a slight concavity below it, where the otherwise weak growth wrinkles are strengthened into short, recurved little folds. Aperture ovate, fleshy whitish inside. Columella very little thickened, slightly concave, obliquely subtruncate below. Parietal callus very thin, transparent.

Length, 55.9 mm; diameter, 30.5 mm; aperture, 30 mm long; 7½ whorls.

Remarks.—This species is related to *P. gouldii* (Reeve), which under the microscope shows a similar pattern of crisscross scratches; but in that species the shape is slenderer and the aperture smaller, less than half of the total length, while in our species it is decidedly more than half. It is a thinner shell than *P. torridus* (Gould) and quite different in the microscopic sculpture.

A note by the collector states that this snail is used for food.

There is a young shell (U.S.N.M. No. 151003), taken by the same collector at the same place, that measures: Length, 36.7 mm; diameter, 26 mm; 6 whorls; at this stage the periphery is rather strongly angular.

PSEUDOTROCHUS AURIPIGMENTUM MUSCARUM, new subspecies

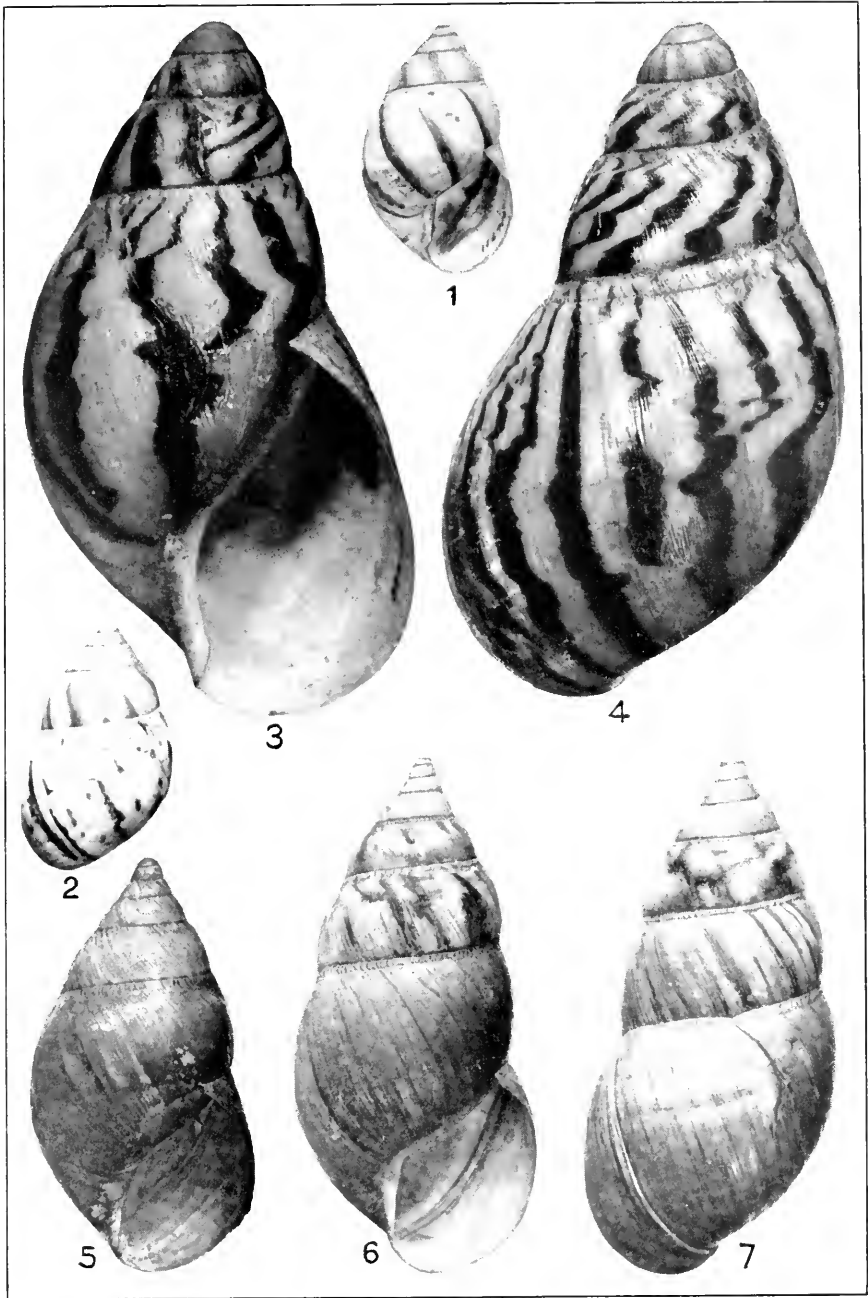
PLATE 2, FIGURES 1, 2

Type.—U.S.N.M. No. 336169, collected by Aschemeier, Collins-Garner French Congo expedition, at Agouma, Rem Nkami, Gaboon Colony, French Congo.

Description.—The last whorl is cinnamon-buff, paler toward the suture and in a band below the angular periphery, an ill-defined darker band above it; sprinkled with chestnut dots; on the penultimate whorl there are some oblique dark smears and scattered opaque white spots in its upper half. Next earlier two whorls with short, dark flames in the upper half; apical whorls nearly white. Columella and parietal callus chestnut-brown.

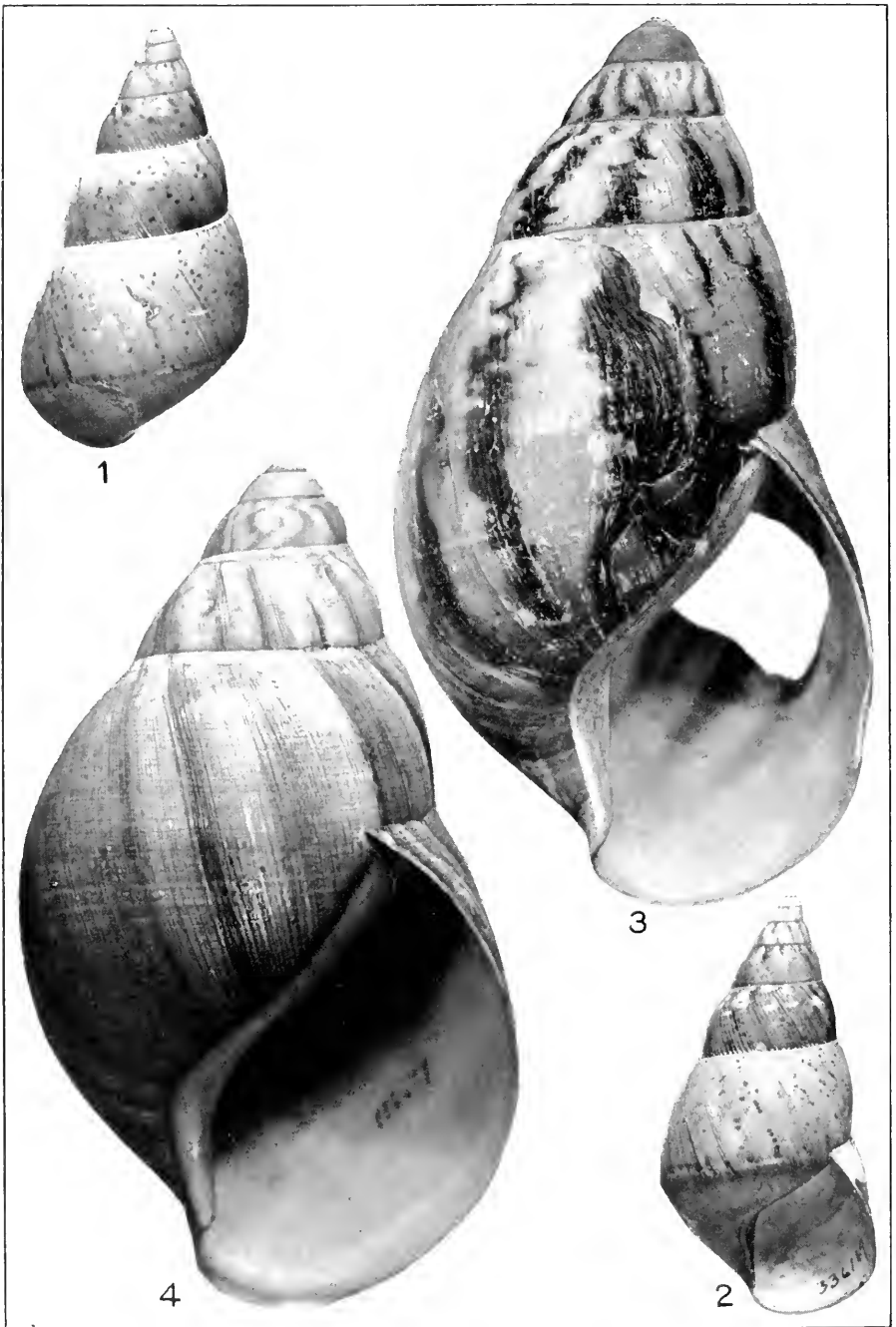
Length, 56 mm; diameter, 29.3 mm; 7 whorls.

Remarks.—The locality of this race is farther south than that of *P. auripigmentum* or of any of its other races.



WEST AFRICAN SNAILS

1, 2, *Pseudotrochus turbinatus* (Lea): Face and back views of the type; 3, 4, *Archachatina gaboonensis*, new species: Face and back views of the type; 5, *Pseudotrochus coffeamontis*, new species: Face of the type; 6, 7, *P. lei*, new species: Face and back of the type.



WEST AFRICAN SNAILS

1, 2, *Pseudotrochus auripigmentum muscarum*, new subspecies: Back and face views of the type; 3, *Archachatina gaboonensis lambarencensis*, new variety: Face of the type; 4, *A. spectaculum*, new species: Face of the type.

DESCRIPTIONS OF NEW AND IMPERFECTLY KNOWN
SPECIES AND GENERA OF GOBIOID AND PLEURO-
NECTID FISHES IN THE UNITED STATES NATIONAL
MUSEUM¹

By ISAAC GINSBURG

United States Bureau of Fisheries

In my studies of the fishes of the Gulf of Mexico, I found it necessary to prepare monographic accounts of the genera *Gobiosoma* and *Paralichthys*, in order to establish definitely the taxonomic status and the morphological as well as the geographical limits of the fishes of these genera occurring on the Gulf coast of the United States. As a result of these studies, new species have been discovered in the collection of the National Museum, and these are described in this paper. The courtesy of Dr. Alexander Wetmore and Dr. Leonhard Stejneger, of the National Museum, in placing the material and the facilities of the Museum at my disposal, is thankfully acknowledged. The three drawings for this paper were made by Miss Louella E. Cable, of the United States Bureau of Fisheries.

Family PLEURONECTIDAE

Subfamily PARALICHTHYINAE

Genus PARALICHTHYS Girard

PARALICHTHYS SCHMITTI, new species

Description of type.—Sinistral. Scales ctenoid on eyed side, cycloid on blind side, in 68 rows over straight part of lateral line to end of hypoural, about 29 rows over the curved part. Accessory scales present on both sides, very numerous, nearly covering surface of many regular scales, and massed in bands around edges of nearly all scales. Scales cover entire head and body, except lower jaw and snout of both sides and preopercle and maxillary of blind side; preopercle of eyed side completely scaled; maxillary of eyed side incompletely scaled at distal end; small more or less embedded scales extending on rays of vertical fins except those near either end; ventral on eyed side

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with similarly small and embedded scales; ventral of blind side and pectoral of both sides without scales evident at the surface; caudal covered with small scales on both sides nearly to posterior margin. Gill rakers quite short, nine on lower limb of first gill arch, three on upper limb with a tubercle above, the same number on both sides. D. 80. A. 63. Pectoral rays 12 on both sides. Origin of dorsal a little in advance of anterior margin of eye; base curving downward anteriorly, to blind side; anterior rays considerably shorter than those over middle part of body; all rays simple, except last 10, the penultimate ray and the three next to it, in front, branching dichotomously twice, the others branching but once. Origin of anal somewhat in advance of base of pectoral; all rays simple except last 11. Ventrals symmetrically placed, equal in length, the tip reaching to base of second anal ray. Pectoral of eyed side a little longer than that of opposite side, not reaching lateral line on either side. Caudal biconcave. Maxillary extending backward somewhat past a vertical through posterior margin of lower eye at a distance less than the diameter of the pupil. Teeth in one row; anterior teeth of upper jaw quite large, caninoid, lateral ones quite small; teeth of lower jaw subequal, but slightly decreasing in size posteriorly, nearly as large as anterior teeth of upper jaw. Mouth oblique, outline of gape somewhat curving; a horizontal line through distal edge of upper lip falling somewhat below upper edge of lower eyeball; lower jaw equal in front with upper jaw, its anterior edge vertical; chin angular; articulation of mandible on a vertical behind posterior margin of eye. Anterior and posterior margins of lower eye placed somewhat behind those of upper. Anterior nostril with a comparatively short flap behind and with a raised edge in front; posterior nostril somewhat larger, its rim not raised. Preanal spine not evident on surface. Length of a chord subtending the curve in the lateral line 3.2 in straight part to end of hypoural, a vertical from a chord to apex of curve three times in chord.

*Measurements.*²—Total length, 455. Standard length, 381. Depth, 168 (44.1); head (to end of scaled part, not including the soft border), 114 (29.9); maxillary, 58 (15.2); interorbital, 12 (3.2); pectoral of eyed side, 47 (12.3); pectoral of blind side, 42.5 (11.2); caudal, 75 (19.7); ventral, 33.5 (8.8); depth of caudal peduncle, 36 (9.5); snout, (to upper eyeball), 33.5 (8.8); eyeball, 17.5 (4.6).

Color.—Eyed side quite dark, irregularly shaded. Some more or less diffuse spots present, two or three very faintly suggesting ocelli. Pectoral of eyed side with transverse rows of somewhat elongate spots. Two diffuse curved bands on caudal, against an irregularly shaded background. Lower side normally light colored, the vertical

² Measurements in this paper are recorded as follows: The first number is the actual measurement of the given part in millimeters; the number in parentheses is the percentage in the standard length.

fins, the ventral, and the distal third of caudal with well-defined dark blotches; a narrow area along upper and lower margins, anteriorly, speckled with small brown spots, the speckling continued, but less distinct, on eyed side.

Holotype.—U.S.N.M. No. 88831. Juan Fernandez Island, Chile. The specimen was collected by Dr. Waldo L. Schmitt, curator of marine invertebrates in the National Museum, during his investigations of the marine fauna of South America, and I take pleasure in naming the species after Doctor Schmitt.

Remarks.—This species is closely related to *Paralichthys fernandezianus* Steindachner,³ but the latter species evidently has much smaller scales. In his original description of *fernandezianus*, Steindachner states "L.l.c. 140." This is a number greater by a wide margin than several other species of *Paralichthys* described by the same author and shows an unusually finely scaled species. In the type specimen of *schmitti* the grooved scales in the lateral line are covered by thick skin and numerous accessory scales, and are partly hidden by the overlapping normal scales on either side. An exact count of the modified scales in the lateral line is therefore impossible; but the number of such scales very closely coincides with the number of oblique rows over the lateral line, or approximately 97. This number approximates that of most species belonging to the typical subgenus *Paralichthys*, while that given for *fernandezianus* shows too wide a difference to be accounted for by individual variability. Another significant difference in the types of the two species is found in the number of gill rakers. That difference, however, may be due to individual variability, and its true value, if any, may be determined only by a frequency distribution study of numbers of individuals. Another species with which the present should be compared is *Paralichthys hilgendorfi* Steindachner.⁴ It is to be noted that the present species has the fins very distinctly blotched on the blind side, an unusual color mark for a species of *Paralichthys*. The dorsal in *fernandezianus* is also blotched, but this unusual color pattern is not described for *hilgendorfi* and is evidently not present in the latter. As to structural differences, comparing the specimen studied with the description of *hilgendorfi*, we find that it has one more ray in the pectoral, which is also shorter, the maxillary is longer, the snout longer, the eye smaller, and the interorbital wider. The last two differences may be due to the difference in size of the specimens; but the other characters are of use in indicating specific divergences in *Paralichthys*, although the exact morphological limits remain to be worked out on series of specimens, as is necessary in all other

³ Fauna Chilensis, vol. 3, p. 208, 1905 (Zool. Jahrb., Suppl.-Band 6).

⁴ *Idem*, p. 209.

closely related species of this genus. Still another significant difference is that the type of *hilgendorfi* is dextral while that of *schmitti* is sinistral, but the true value of this difference is again indeterminate from single specimens. Most species of *Paralichthys* are constantly sinistral, but two species at least are also frequently dextral. Finally, in his account of *hilgendorfi*, Steindachner describes "Eine sehr stumpfe knöcherne Leiste auf der Stirne, schräge nach vorn zur Schnauze ziehend", a condition not evident in *schmitti*. From all other species of *Paralichthys*, except *fernandezianus* and *hilgendorfi*, having ctenoid scales on eyed side and cycloid on blind side, and occurring on the Pacific coast of North and South America, *schmitti* is distinguished by the small number of gill rakers.

PARALICHTHYS TROPICUS, new species

Description of type.—Sinistral. Vertebrae 10+26. Scales cycloid on both sides, in 67 oblique rows over straight part of lateral line to end of hypoural, 28 in a chord subtending the arch in the lateral line, 34 oblique rows over the arch. Accessory scales present on both sides, quite numerous, except in area along the middle posterior part of body; most other regular scales on body having a complete circle of small accessory scales around their edges. Scales covering entire head and body, except lower jaw and snout of both sides and preopercle and maxillary of blind side; preopercle of eyed side incompletely scaled, a few scales at end of maxillary of eyed side; smaller scales extending on rays of vertical fins, except those near either end, on ventral of eyed side and on caudal nearly to its end. Both pectorals and ventral of blind side scaleless. Gill rakers rather short, but little longer than pupil, 11 on lower limb (12 on eyed side) of first gill arch, 2 on upper limb at the angle with 2 tuberosities above. D. 75. A. 58. Pectoral rays 11 on both sides. Origin of dorsal nearly on a level with anterior margin of eye, base curving downward anteriorly to blind side, anterior rays distinctly shorter than those near posterior part of body; origin of anal somewhat in advance of base of pectoral; last 12 rays of vertical fins branched, others simple. Ventrals of both sides symmetrically placed, subequal in length and width of base, the tip reaching to base of third anal ray. Pectoral of eyed side reaching angle of curve in lateral line, the one on blind side falling considerably short of angle. Caudal distinctly biconcave. Maxillary reaching slightly past a vertical through posterior margin of orbit. Teeth in one row, unequal, the anterior ones considerably enlarged, posterior teeth of upper jaw very small and close-set. Mouth very oblique, a horizontal line through outer edge of upper lip nearly passing through upper rim of lower orbit; lower jaw somewhat projecting; chin angular; articulation of mandible angular, falling at some distance behind posterior rim of orbit. Position of

lower eye somewhat behind upper. Anterior nostril with a comparatively short flap on hind edge; posterior nostril larger, its rim not raised. Preanal spine not evident. Length of a chord subtending the curve in the lateral line 3.4 in straight part, to end of hypoural, a vertical from a chord to apex of curve 2.7 in the chord. Specimen faded and color can not be described.

Measurements.—Total length, 321. Standard length, 264. Depth, 116 (44); head (to end of scaled part, not including the soft border), 74 (28); maxillary, 36 (13.6); interorbital, 5.8 (2.2); pectoral of eyed side, 41 (15.5); pectoral of blind side, 32.5 (12.3); caudal, 56 (21.2); ventral of eyed side, 25.8 (9.8); ventral of blind side, 24.3 (9.2); depth of caudal peduncle, 27.5 (10.4); snout, 18 (6.8); eyeball, 12.8 (4.8); straight part of lateral line, 150 (56.8).

Holotype.—U.S.N.M. No. 34919. Latitude 10° 37' 40" N., longitude 61° 42' 40" W. (off Trinidad, West Indies); February 3, 1884; 31 fathoms; beam trawl; *Albatross*.

Remarks.—This species is evidently very close to *Paralichthys squamilentus* Jordan and Gilbert,⁵ but it differs in a number of characters. The vertebrae in the type specimen are 10 + 26, while in one specimen of *squamilentus* that has been dissected they are 10 + 28. The most striking difference on superficial examination is the presence of numerous accessory scales in *tropicus*, while of all the specimens of *squamilentus* now known but a single accessory scale was found on one after a prolonged search with a binocular microscope. *P. squamilentus* has a very deep body, in seven specimens measured, 96 to 120 mm in total length, the depth varied 46.6 to 52.3 per cent of the length without caudal, while in the type of *tropicus* it is 44 per cent. The numbers of fin rays in the dorsal and anal of the type fall just outside the frequency distributions for these characters in 12 specimens of *squamilentus*. Of the characters enumerated, the depth, and the profuseness of accessory scales in those species of *Paralichthys* in which they are present, are dependent on age to a certain extent, and since the largest known example of *squamilentus* is but 120 mm long, the available specimens of the latter species are consequently not fairly comparable with the larger specimen here described. Nevertheless, the differences are too pronounced to be caused wholly by the variation in the size of the specimens compared. When the sum total of differences is considered it becomes evident that the specimen here described represents a hitherto unknown species, although the precise degree of divergence between *squamilentus* and *tropicus* remains to be elaborated by frequency distribution studies of the meristic differentiating characters, as it is, indeed, necessary to do in nearly all species of *Paralichthys*. A consideration of the remote location of the two species, taken by itself, presents the probability strongly in favor

⁵ Proc. U. S. Nat. Mus., vol. 5, p. 303, 1882.

of the two species being distinct, since the numerous American species of *Paralichthys*, with one or two exceptions, have a markedly restricted distribution. No specimen of *Paralichthys* has hitherto been recorded from that long stretch of coast in the western Atlantic, extending from Florida or from Texas to Rio de Janeiro, except one specimen of *brasiliensis*, which Günther doubtfully referred to Guatemala.⁶ From *Paralichthys brasiliensis* (Ranzani),⁷ which occurs nearer the range of the present species, *tropicus* may be distinguished by the lesser number of gill rakers and the more numerous accessory scales. The difference between the present and other closely related species will be taken up in greater detail in a monographic study of the genus *Paralichthys* now in course of preparation.

Subfamily BOTHINAE

Genus ENGYOPHRYS Jordan and Bollman

ENGYOPHRYS SENTUS, new species

Description of type.—Sinistral. D. 79. A. 64. Lateral line with a high arch in front and well developed on eyed side, each scale having a raised longitudinal canal or a groove; almost absent on blind side, no trace of arch and no well-developed canals or grooves on scales, only a few having a feeble dent or groove near center. Anterior accessory branch of lateral line feebly developed on eyed side, short, V-shaped, disconnected from main lateral line. Scales ctenoid on eyed side, cycloid on blind side, quite large, 14 in curve of lateral line, 37 in straight part to end of hypoural and 1 similarly large perforate scale on base of caudal. Scales cover entire head and body, except snout and lower jaw. No accessory scales. Gill rakers very short, pimplelike, 4 on lower limb of first gill arch on blind side, 6 on eyed side; upper limb almost smooth on blind side, 3 very minute, hardly perceptible protuberances on eyed side. Mouth very small, maxillary falling short of anterior margin of eye. Eyes large, the lower having its position somewhat more anterior than the upper. Interorbital narrow, reduced to mere ridge, with four spines more or less directed backward, the first in a line with anterior margin of lower eyeball and but slightly inclined backward, the third nearly over middle of lower eye and strongly inclined to horizontal, the first three about evenly spaced and gradually making a more acute angle with a horizontal plane; the fourth spine blunt, horizontal, and more remotely spaced, situated just behind posterior margin of lower eyeball. A spinous process on ocular shelf, in front of upper eye, directed upward; two such processes in front of lower eye, approximate and more or less directed downward. Teeth absent on eyed side (none seen on examination with a binocular microscope on undissected fish);

⁶ Trans. Zool. Soc. London, vol. 6, p. 473, 1868.

⁷ See U. S. Nat. Mus. Bull. 47, pt. 3, p. 2626, 1898.

teeth on blind side small, pointed, somewhat recurved, in a single row. Origin of dorsal somewhat in front of anterior margin of eye; its anterior rays shorter than those over middle of body; origin of anal nearly under base of pectoral; end of vertical fins not far from base of caudal, resulting in a short peduncle; a short, rather blunt spine in front of anal origin, directed forward. Tip of pectoral on eyed side almost but not quite reaching lateral line, pectoral of blind side but slightly shorter than that on opposite side. Base of left ventral attached to ridge of abdomen, that of blind side having a base not quite so broad and attached slightly above abdominal ridge; tip of left ventral extending but slightly more backward than right, both about extending to base of fifth anal ray. A sharp bony expanded process between the two ventrals, covered with thin skin so as to be plainly visible exteriorly, consisting of two flat, expanded, elongate, spinelike bones, joined together lengthwise, with their tips projecting beyond the skin, spinelike.

Color pattern not evident, probably faded. Upper surface straw-colored, irregularly clouded with bluish. A faint indication of three blotches on lateral line, one at bend, one in front of caudal peduncle, and one in between. Lower surface immaculate.

Measurements.—Total length, 83. Length without caudal, 68. Depth, 38 (55.5); head, 15.5 (22.8); maxillary, 3.8 (5.6); snout, 4 (5.9); eyeball, 5.5 (8.1); interorbital, 1.2 (1.8); depth of caudal peduncle, 7.8 (11.5); caudal, 15 (22.1); left pectoral, 9.4 (13.8); right pectoral, 8.5 (12.5); left ventral, 10 (14.7); right ventral, 8.7 (12.8); straight part of lateral line, 41.5 (61). Length of a chord subtending the arch in the lateral line, 3.5 times in straight part; length of a vertical from the chord to the apex of the arch, 2.5 in the chord.

Holotype.—U.S.N.M. No. 91402. Off Dry Tortugas, Fla.; latitude 24° 23'–25' N., longitude 82° 57'–58' W.; 50 fathoms; November 26, 1919; collected by the *Albatross*.

Remarks.—The present species differs strikingly from *Engyophrys sancti-laurentii* Jordan and Bollman⁸ in having four spines, instead of one, on the interorbital, and in having well-developed spinous processes on the ocular shelves in different positions than the mere protuberances in the older species. The scales in *sentus* are less numerous; and the shape of the body is different, the posterior half not tapering quite so gradually to the caudal peduncle.

Genus SYACIUM Ranzani

SYACIUM GUNTERI, new species

Diagnosis.—No spines on snout. Scales in 47 to 54 oblique rows over lateral line, from upper angle of gill opening to base of caudal (range of 28 individuals), the number of perforate scales in lateral

⁸ Proc. U. S. Nat. Mus., vol. 12, p. 176, 1889.

line a few less, 44 to 51 (range of 19 specimens) to base of caudal, 2 or 3 similar perforate scales on caudal at its base. Dorsal rays 74 to 82. Anal rays 59 to 65. Number of rays in right pectoral usually 9 (in 42 specimens), infrequently 8 (in 4) or 10 (in 2); rays in left pectoral usually 11 (in 36), sometimes 10 (in 11), infrequently 9 (in 1). Gill rakers on upper limb of first gill arch quite small, usually 3 (in 32 fish), often 2 (in 17), rarely 4 (in 1 specimen); quite large on lower limb, nearly always 7 (in 47), infrequently 6 (in 3). Body quite deep, greatest depth about 2 in length without caudal. In 29 specimens 101 to 126 mm in total length, the measurements expressed as a percentage of the standard length vary as follows: Depth, 48.2 to 55, average 51.4; head, 26.7 to 29.5, average 27.6; maxillary, 10.8 to 12.8, average 11.7; eye, 6.5 to 8, average 7.2; right pectoral, 14.6 to 18.6, average 16.7. In 21 specimens 65 to 99 mm long: Depth 47.3 to 53.4, average 49.5; head, 26.7 to 30, average 28.3; maxillary, 10.8 to 12.9, average 11.8; eye, 7.1 to 8.9, average 8; right pectoral, 15.2 to 19.2, average 17. Width of maxillary and length of filamentous ray of left pectoral differing with size, but apparently not markedly with sex. If there is an average difference in the two sexes in the interorbital width and the extent of the longest ray of the left pectoral, it may be determined only by dissection, my rough data not showing any line of demarcation in these two measurements by which to separate the sexes without dissection. The 50 specimens measured, divided into three groups by size, irrespective of sex, gave the following results: In 15 specimens 111 to 126 mm long—interorbital, 3 to 4.5 per cent of standard length, average 3.4; filamentous ray of left pectoral, 23.7 to 35.3, average 27.9. In 21 specimens 94 to 109 mm long—interorbital, 1.9 to 3.9, average 2.9; longest ray of left pectoral, 22.5 to 36.8, average 28.3. In 11 specimens 65 to 92 mm long—interorbital, 1.6 to 3.2, average 2.1; left pectoral, 21 to 28.5, average 24.9.

The frequency distribution of the dorsal and anal rays in 50 specimens is as follows:

DORSAL RAYS

Number of rays-----	74	75	76	77	78	79	80	81	82
Number of specimens----	1	1	3	4	11	12	10	5	3

ANAL RAYS

Number of rays-----	59	60	61	62	63	64	65
Number of specimens----	1	7	7	10	16	7	2

Color.—Nearly uniformly dusky or irregularly shaded with a dirty brown on upper side; two diffuse dark blotches on lateral line, one more or less in front of tip of pectoral, another near ends of vertical fins faintly ocellated; another blotch, faintly ocellated, a little below lateral line, between the other two blotches, sometimes present; other

very diffuse blotches on body sometimes indicated, in rows along bases of dorsal and anal fins and between those and lateral line, some of these blotches faintly ocellated; an ocellated spot on middle of caudal about one-third distance from base to posterior margin usually present, often most marked blotch, with one or two transverse rows of smaller spots behind; vertically elongate, narrow, dark spots, spaced rather widely apart, on dorsal and anal fins.

Material studied.—Off Aransas Pass, Tex.; 5 to 10 fathoms, March 5, 1917; *Grampus*; 21 specimens, 89 to 120 mm in total length. Eleven miles SSW. off Heald Lightship, Tex.; 10 fathoms; March 16, 1917; *Grampus*; 27 specimens, 65 to 111 mm. Off Galveston, Tex.; 4.5 to 10 fathoms; February 26, 1917; *Grampus*; 10 specimens, 87 to 126 mm. About 30 miles off Grand Isle, La.; August 6, 1930; Martin D. Burkenroad; 1 specimen, 124 mm. Twelve miles SE. off Barataria Light, La.; Gordon Gunter; 2 specimens, 109 to 123 mm. Mayaguez, Puerto Rico; *Fish Hawk*; 4 specimens, 89 to 101 mm (U.S.N.M. No. 63047 being part of the material recorded as *Syacium micrurum* by Evermann and Marsh⁹). Total number of specimens examined 65, 65 to 126 mm in length, of which 50 were studied in detail, including the 3 specimens from Louisiana and the 4 from Puerto Rico.

Holotype.—U.S.N.M. No. 92800. One of the specimens taken by Gordon Gunter off the coast of Louisiana, 123 mm in total length, is designated as the holotype.

Remarks.—This is evidently a common species in the Gulf of Mexico. In its deep body and comparatively small number of fin rays the present species closely agrees with (*Rhomboidichthys*) *Syacium cornutum* Günther¹⁰ and differs from the latter in the absence of spines on the snout. From its common congener in the region of the straits of Florida, currently designated as *Syacium papillosum*, probably incorrectly, the present species may be distinguished by fewer fin rays, a deeper body, and by its smaller size, the interorbital in the present species becoming comparatively wide on reaching a size at which specimens of "*Syacium papillosum*" still show the narrow interorbital characteristic of the juvenile. Mr. Gunter, who sent me two specimens from Louisiana for identification at a time when I made a preliminary study of the species, also noted the deep body and the few fin rays of his material as compared with current descriptions. However, there is more or less intergradation between the two species with respect to those characters, and individual fishes are sometimes difficult to refer to their proper species. Material is now being gathered for a revision of the genus *Syacium* in order to take up in greater detail the difference between the several species. This species is named after

⁹ The Fishes of Porto Rico, p. 324, 1900.

¹⁰ Voyage of H. M. S. *Challenger*, Zool., vol. 1, p. 7, pl. 2, fig. B, 1880.

Gordon Gunter, who is a member of the staff of investigators of the Bureau of Fisheries working on the shrimp problem, in appreciation of the aid he rendered in my studies of the Gulf coast fishes during 1931 and for other courtesies shown.

Family ELEOTRIDAE

ELEOTRICA, new genus

Genotype.—*Eleotrica cableae*, new species.

Definition.—Ventrals closely approximated, but altogether separate. Entirely scaleless. First dorsal with seven flexible spines. The two dorsal fins separate. Second dorsal with more rays than the anal, 12 and 11 rays, respectively. Teeth pointed, in bands, outer row of both jaws more or less enlarged, but no definite canines; no teeth or vomer or palatines. Body moderately elongate. Caudal short, rounded. Maxillary moderate, not extending past posterior margin of eye. No spine on preopercle. Shoulder girdle without flaps of skin. Tongue rather emarginate, the cleft not deep. Cutaneous papillae on cheek in transverse and longitudinal rows; a series of short transverse rows along middle of body; some of papillae on top of head and over opercle greatly developed to form short tubules.

Remarks.—Of the known gobioid genera, as far as their external characters are concerned, *Eleotrica* seems to be most nearly related to *Chriolepis* Gilbert.¹¹ A reexamination of the type of *Chriolepis minutillus* brings to light some inaccuracies and omissions in the original description, which are here corrected in order to show the divergence between the two genera. *C. minutillus* has some well-developed scales posteriorly. There is a single row of four strongly ctenoid scales on the caudal, at its base. The spinules at the hind margin of these scales are conspicuously well developed, especially on the upper and lower scales, which are considerably larger than the other two, and the spinules laterally are very long, becoming gradually shorter toward the center. There are also two large scales on the caudal peduncle, one behind the other, near the base of the caudal fin. Whether other scales were originally present is not evident on the type specimen. The scales as described above are present only on the right side; the left side having but a single scale left, the others apparently having fallen off. No tubular pores are present. The teeth are in more than one row in both jaws, as in related genera, not in a single series in the mandible as described originally. Cutaneous papillae on the cheek are not evident in the type specimen, but this may be due to its state of preservation. *Eleotrica*, therefore, differs from *Chriolepis* chiefly in the total absence of scales and in some of the pores being markedly tubular. In its physiognomy *Eleotrica* is quite similar to *Gobiosoma* (see p. 13).

¹¹ Proc. U. S. Nat. Mus., vol. 14, p. 557, 1891.

ELEOTRICA CABLEAE, new species

FIGURE 1

Gobiosoma crescentale KENDALL and RADCLIFFE (not Gilbert), Mem. Mus. Comp Zool., vol. 35, p. 148, 1912 (Chatham Island, Galapagos Archipelago).

Description of type.—Body moderately elongate, depth 5.2 in length without caudal. Head quite depressed, its depth behind eye 2.3 in its length. Mouth somewhat oblique, lower jaw projecting. Maxillary extending to a vertical nearly through posterior margin of eye. The two nostrils in front of eye, one behind the other, both ending in a tubule. Teeth pointed, in bands, outer row of upper jaw markedly enlarged, outer and inner rows of lower jaw moderately enlarged. Anterior margin of tongue with a rather shallow emargination. Ventral 1.4 times in distance from its base to origin of anal, its base under that of pectoral; the two ventrals entirely disconnected; their bases very closely approximated; no interspinal membrane.

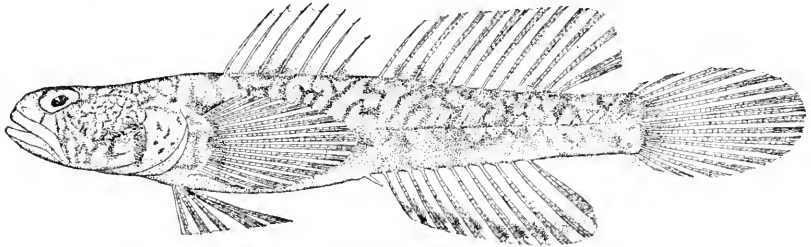


FIGURE 1.—*Eleotrica cableae*, new species, from the type specimen

D. 7–12. A. 11. Origins of second dorsal and anal nearly on same vertical; end of anal base under base of third dorsal ray from its end; posterior rays of dorsal and anal nearly, but not quite, reaching base of caudal. Dorsal spines only slightly filamentous, the fourth not quite reaching origin of second dorsal, the fifth just reaching origin. Tip of pectoral about reaching a vertical through vent.

Five pores ending in tubules; 3 behind eyes, 1 on midline, and 1 on a level through the middle of each eye; 1 each at upper anterior corner of opercle; height of tubules about equaling two-thirds diameter of pupil. Four transverse rows of papillae on cheek, the first 3 rows under eye, more or less oblique, the fourth vertical, very slightly behind eye; 2 very short rows radiating from eye between third and fourth rows; 2 short longitudinal rows on cheek not so well marked; 2 rows on underside of lower jaw continued upward along margin of preopercle, the papillae of the inner row being coarser; a transverse row along anterior margin of opercle, 2 lengthwise rows on opercle, 1 above and 1 below; a few small groups of papillae over the opercle; a short transverse row behind eye; a series of short transverse rows along middle of body.

Measurements.—Total length, 69. Standard length, 54.5. Depth, 10.4 (19.1); least depth of caudal peduncle, 6.8 (12.5); length of ventral, 11.9 (21.8); distance from ventral to anal origins, 17.3 (31.7); length of head, 15.6 (28.5); depth of head directly behind eye, 6.7 (12.3); maxillary, 7.2 (13.2); snout, 3.7 (6.8); eyeball, 3.3 (6.1); interorbital, between soft margin, 2 (3.7); postorbital part of head, 10 (18.3); antedorsal distance, 19 (34.9); caudal, 14.3 (26.2).

Color.—Head and body prettily marbled with brown and yellow, without definite crossbars. Two yellowish bars on cheek rather faintly indicated. The marblings on the back at the base of the first dorsal faintly tend to a cross-streaked arrangement. Ventral aspect plain yellowish. Fins plain, more or less uniformly dusky; caudal with a transverse band of dusky, more intense than rest of fin, flush with its base and having a convex margin posteriorly.

Holotype.—U.S.N.M. No. 65517. Male. Chatham Island, Galapagos Archipelago; January 7, 1905; collected on shore by the *Albatross*.

Remarks.—Two specimens of this species, taken at the same place, were recorded by Kendall and Radcliffe. Only the type has been studied by me. In preparing a revised account of the genus *Gobiosoma*, I studied the specimen described above, intending to include it in that genus as a new species. On drawing an illustration of the specimen, Miss Louella E. Cable, after whom I take pleasure in naming the species, called my attention to the ventral fins not being united, showing that the species is not a member of *Gobiosoma*.

Family GOBIIDAE

GOBULUS, new genus

Genotype.—*Gobulus crescentalis* (Gilbert) = *Gobiosoma crescentalis* Gilbert.

Definition.—Ventral fins united (in the three specimens of the genotype examined the ventrals are united only for about half their extent, at the base, but the distal half of the membrane is apparently torn, the ventrals probably having been united for their whole extent in life). No interspinal membrane. Entirely scaleless. First dorsal with seven flexible spines. The two dorsals separate. Second dorsal having more rays than the anal, 12 and 11 rays, respectively. Teeth in bands in both jaws, the outer rows enlarged; no canines. Body moderately elongate. Caudal short. Maxillary moderate, not extending past posterior margin of eye. Shoulder girdle without flaps of skin. Tongue entire. Cutaneous papillae on cheek in transverse and longitudinal rows; a series of short transverse rows present on middle of body.

Remarks.—While this new genus agrees with *Gobiosoma* in nearly all technical characters, it differs radically from the latter as well as

from nearly all other genera of the family Gobiidae in lacking an interspinal membrane. The families Eleotridae and Gobiidae are now distinguished mainly by the structure of the ventral fins. In the Gobiidae the two ventrals are united medially by an interradiial membrane, while a shorter membrane nearly always arches across the two fins, being attached to the short lateral ray of each fin and to the base of the fins in front, thus forming a scoop or funnel-shaped structure. In the Eleotridae the two ventrals are closely approximated but not joined together. It is to be noted that the three genera *Eleotrica*, *Gobulus*, and *Gobiosoma*, which otherwise agree in nearly all technical characters and are very similar in general appearance, form a gradated transition from the Eleotridae to the Gobiidae in so far as it relates to the structure of the ventral fins. An even more striking transition between the two families was recently described in the case of some European scaled gobies.¹² It is evident that the chief character hitherto employed in separating the two families is not satisfactory. Moreover, the divergence in the structure of the ventrals apparently occurred independently in widely separated phylogenetic lines. Regan¹³ attempts to divide the two families on the basis of osteological characters also, but since his study is apparently based on very few genera, it is not conclusive. The proper separation of the two families, showing their differences and their limits, still remains to be worked out.

GOBULUS CRESCENTALIS (Gilbert)

FIGURES 2, 3

Gobiosoma crescentalis GILBERT, Proc. U. S. Nat. Mus., vol. 14, p. 557, 1891
(Gulf of California, lat. 24° 22' 15" N., long. 110° 19' 15" W.; 7 fathoms).

Gobiosoma crescentale JORDAN and EVERMANN, U. S. Nat. Mus. Bull. 47, pt. 3,
p. 2259, 1898 (erroneously said to have been taken in 79 fathoms).

Gobiosoma crescentale PELLEGRIN, Bull. Mus. Hist. Nat. Paris, vol 7, p. 162, 1901
(Gulf of California).

Gobiosoma crescentale OSBURN and NICHOLS, Bull. Amer. Mus. Nat. Hist., vol. 35,
p. 175, 1916 (Agua Verde Bay, Gulf of California).

Diagnosis.—D. 12, A. 11 (same count in three specimens examined). Greatest depth, 15.3–17 per cent; least depth of caudal peduncle, 9.8–11.2 per cent; head, 27.6–28.6 per cent; ventral, 20.2–21.4 per cent of standard length. Head markedly depressed, flat on top, its lower profile somewhat curved, its depth directly behind eyes 2.5 in its length. Ventral of medium length, 1.7 times in distance from its base to origin of anal. Both nostrils in front of eye, one behind the other, ending in short tubules. Three pimplelike projections of skin behind inner margin of upper lip, one below anterior nostril and two near level of lower margin of eye. Inner row of papillae along lower jaw

¹² See De Buen, Trab. Inst. Español Oceanogr., no. 5, 1930.

¹³ Ann. Mag. Nat. Hist., ser. 8, vol. 8, pp. 729–733, 1911.

conspicuously enlarged to form tiny flaps. Three transverse rows of papillae under eye and a fourth on cheek behind eye. A few short rows radiating from eye. One lengthwise row nearly at middle of cheek extending for a short distance from upper lip. Two rows along lower jaw, extending upward along posterior margin of preopercle, the inner row conspicuously enlarged, as stated. A trans-

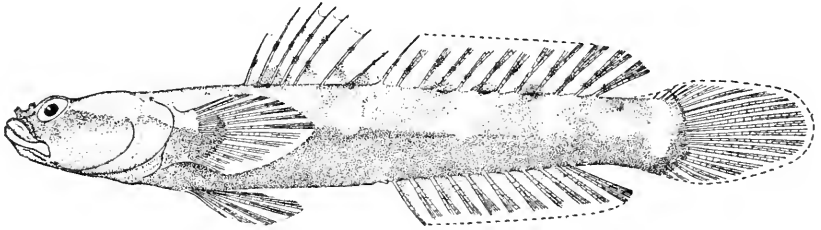


FIGURE 2.—*Gobulus crescentalis* (Gilbert), from the type specimen

verse row along anterior margin of opercle, and two short lengthwise rows on opercle. A series of short transverse rows along middle of body.

Color.—Ventral aspect of fish darker in color than upper part. Lower half uniform cocoa brown, the rather coarse chromatophores being evenly distributed. Upper half lighter, yellowish blotched with brown, the yellowish ground color forming a series of more or less diffuse, vertically elongate, light-colored areas. Caudal with a brown

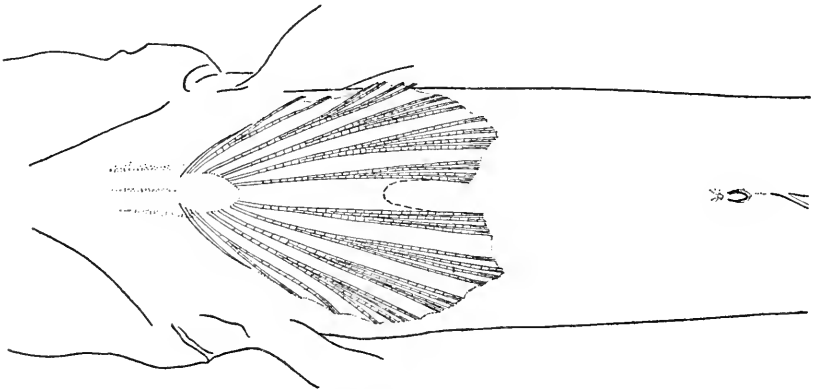


FIGURE 3.—A ventral view of *Gobulus crescentalis* (Gilbert) showing the ventral disk. Note the absence of an interspinal membrane. The two ventrals are disconnected distally, the interradiial membrane, most probably, being torn

crescent-shaped band, near to but a little removed from its base; the upper end of the band narrow, the lower end broader and merging with the pigment of the caudal peduncle. The two specimens from Agua Verde Bay are darker than the type; they have the dark crescent on the caudal wider and somewhat merging posteriorly with the diffuse pigmentation of the rest of the fin; and they also show a

lengthwise row of small dark spots above the median line of the body, continued on the upper aspect of the head, the row extending from the preopercle nearly to base of the caudal.

Remarks.—This species may be readily recognized by its peculiar coloration, as well as the distinctive structural characters. The above account is based on the type and on the two specimens from Agua Verde Bay recorded by Osburn and Nichols, the total length of the three specimens ranging from 34 to 41 mm.

Genus GOBIOSOMA Girard

GOBIOSOMA ROBUSTUM, new species

Description of type.—No scales on caudal. Mental frenum not bilobed. D. 7–12. A. 10. Body quite short and stocky. Head moderately depressed, depth behind eye 1.7 in its length. Cheeks tumid. Mouth oblique, lower jaw but slightly included, nearly co-terminal with upper jaw; lips fleshy. Maxillary reaching to a vertical through posterior margin of pupil. Teeth in bands, outer and inner rows of both jaws, considerably enlarged. Anterior nostril ending in a short tubule; posterior nostril with its rim slightly raised. Barbule in front of eye not evident. Base of ventral and that of pectoral nearly on same vertical; origin of first dorsal at some distance behind this. Tip of pectoral not quite reaching to a vertical through origin of second dorsal. Ventral of medium length, 1.5 in distance from its origin to origin of anal, 21 per cent of body length. Origin of second dorsal but slightly in advance of that of anal; end of anal under base of third dorsal ray from its end. Tips of posterior dorsal rays reaching base of caudal, those of anal not reaching quite that far. Membrane from last dorsal ray closely adherent to back, the normal position of that ray being nearly horizontal.

Measurements.—Total length, 55.5. Standard length, 45. Depth of body, 11.4 (25.3); least depth of caudal peduncle, 7 (15.6); depth of head directly behind eye, 8 (17.8); length of head, 13.6 (30.2); maxillary, 6 (13.3); snout, 4 (8.9); eye, 3 (6.7); interorbital, soft part, 3.5 (7.8); postorbital part of head, 8.7 (19.3); antedorsal distance, 15.7 (34.9); ventral, 9.6 (21.3); pectoral, 10.9 (24.2); caudal, 10.6 (23.5); distance from ventral to anal origins, 14.5 (32.2).

Color.—Body crossbarred with nine broader brown bands, alternated with narrower, lighter bars; the alternating bands and bars not sharply differentiated; the brown bands not uniformly colored, mottled with lighter and darker shades; the lighter crossbars not altogether straight, more or less sinuous or oblique, sometimes incomplete. A median row of small brown spots, distinct, one on a brown band, sometimes two. Fins nearly uniformly dusky, ventral and first dorsal darkest, the latter somewhat blotched with black.

Holotype.—U.S.N.M. No. 92802. Male. Laguna Madre, near Corpus Christi Pass, Tex.; April 7, 1927; collected by John C. Pearson.

Remarks.—This is a very common species on the northern part of the Gulf of Mexico; but it has, as yet, received no name. Another species, *bosci*, is also common on the Gulf coast. Both of these species have been confused by most authors and treated under one name. The name applied in the literature to this composite of two common species has been either *molestum* or *bosci*, depending on whether any particular author "regarded" the population of common naked gobies on the Gulf coast as being distinct from that of the Atlantic coast or identical. The type of *molestum*, which has been examined, proved to be a specimen of *bosci*, thus requiring a name for the second common species. *Gobiosoma robustum* is readily separated from *bosci* by fewer fin rays in the dorsal and anal, by a longer ventral disk, and by a different color pattern. The naked gobies of the Atlantic and Gulf coasts of the United States have been badly confused in the literature and have been distinguished and identified generally by geographical lines rather than by morphological differences. A revision of the genus, showing in detail the morphological as well as the geographical limits of the species, is now nearly completed. Specimens of the present species were examined from Indian River at Cocoa, east coast of Florida; Cape Sable, Fla.; Apalachicola and Pensacola, west coast of Florida; Cat Island, Miss.; Grand Isle, La.; and Corpus Christi, Tex.

ARUMA, new subgenus

Subgenotype.—*Gobiosoma occidentale*, new species.

Definition.—This subgenus differs chiefly from typical *Gobiosoma* in having a deeply cleft tongue, a character which is currently used in separating gobiid genera. The small but well-developed barbule in front of the eye, which is present in *Aruma*, is but faintly indicated or rudimentary in typical *Gobiosoma*, while the head is markedly more depressed in *Aruma*. Besides the following new species, this subgenus includes also *Gobiosoma histrio* Jordan.¹⁴

GOBIOSOMA OCCIDENTALE, new species

Description of type.—No scales on caudal. Mental frenum not bilobed. D. 7-12. A. 11. Body markedly slender, depth 6.1 times in length without caudal. Head notably depressed, its depth directly behind eyes 2.5 times in its length, considerably less than its width at the same point. Mouth somewhat oblique, outer edge of upper jaw on a horizontal line below lower margin of eye; lower jaw somewhat projecting; lips wide. Maxillary about reaching a vertical through posterior margin of pupil. Anterior nostril in a short tubule;

¹⁴ Proc. U. S. Nat. Mus., vol. 7, p. 260, 1884.

posterior nostril with a raised margin, the rim in front being continued into an expanded tiny flap fitting snugly over opening of nostril when bent over. Barbule in front of eye at posterior edge of upper lip small but very distinct. Tongue with a rather broad, V-shaped emargination in front, continued into an abrupt narrow cleft of medium depth, at mid line. Teeth in bands, those in outer row in either jaw, especially those in upper jaw, conspicuously enlarged. Base of ventral nearly under that of pectoral, tip of latter falling short of a vertical through anus. Origin of first dorsal considerably behind base of pectoral. Origin of second dorsal a little in advance of the anal, end of base of latter under base of tenth dorsal ray; posterior margins of both vertical fins free, not connected by membrane to mid line. Body light brown with six lighter yellowish cross bands, rather diffuse, not sharply differentiated. Fins without color marks, plain yellowish.

Measurements.—Total length, 44.2. Standard length, 36.4. Depth, 6 (16.5); least depth of caudal peduncle, 3.7 (10.2); length of head, 10.6 (29.1); depth of head behind eye, 4.3 (11.8); ventral, 6.7 (18.4); distance ventral to anal origin, 12.2 (33.5); maxillary, 4.6 (12.6); snout, 2.8 (7.7); eye, 2.5 (6.9); interorbital, 1.4 (3.8); postorbital part of head, 6.5 (17.9); antedorsal distance, 14 (38.5); caudal, 8.2 (22.5).

Holotype.—U.S.N.M. No. 92801. Female. La Paz Harbor, Gulf of California; March 12, 1889; *Albatross*.

Remarks.—The present species is evidently closely related to *Gobiosoma histrio* Jordan but differs in the more slender caudal peduncle and body, in having fewer fin rays, and in the color.

DILEPIDION, new subgenus

Subgenotype.—*Gobiosoma ginsburgi* Hildebrand and Schroeder.

Definition.—This subgenus differs from typical *Gobiosoma*, as well as from the subgenus *Aruma*, in having 2 ctenoid scales, and 2 only, on the base of the caudal fin, 1 near the upper margin and 1 near the lower. This character is very constant in many specimens of *ginsburgi* examined and are conspicuous in fish as small as 22 mm in standard length (the smallest examined). The two scales are usually firmly adherent, but sometimes one or more have fallen out, in which case their pockets are readily discernible and are attached to the hind margin of the caudal peduncle, one near the upper corner and one near the lower. The subgenus *Gerhardinus* Meek and Hildebrand,¹⁵ like *Dilepidion*, also has two ctenoid scales on the base of the caudal, but the new subgenus differs in not having the mental frenum bilobed. Besides the subgenotype, the following new species belongs to the present subgenus.

¹⁵ Field Mus. Nat. Hist. Publ. Zool., vol. 15, pt. 3, p. 889, 1928.

GOBIOSOMA LONGIPALA, new species

Description of type.—Scales on base of caudal fin have fallen out, but three pockets plainly evident in the same positions occupied by the scales in *ginsburgi*, the fourth pocket probably torn. Mental frenum not bilobed. D. 7–12. A. 10. Head flattened on top and markedly depressed, the strikingly depressed head probably partly due to being thrown out of shape by spasmodic movements of the fish after capture or after being placed in preservative, but the species apparently having an unusually depressed head as a normal condition. Body moderately slender. Mouth rather large, somewhat oblique, lower jaw included. End of maxillary nearly on a vertical through posterior margin of eye. Anterior nostril in a short tubule, posterior nostril with a raised rim. Barbule in front of eye reduced to a mere pimple. Teeth in bands, outer row, especially that of upper jaw, strongly enlarged. Origins of first dorsal and ventral nearly on same vertical, which falls slightly behind base of pectoral. End of pectoral about attaining a vertical through origin of anal. Middle rays of ventral disk reaching fully to origin of anal. Origins of second dorsal and anal nearly on same vertical, tips of their posterior rays not reaching base of caudal; end of anal base under base of tenth dorsal ray. Dorsal spines moderately filamentous, tip of fifth spine reaching back to base of third ray of second dorsal. Caudal not pointed, rather short.

Measurements.—Total length, 39. Standard length, 31. Depth of body, 6.2 (20); depth of caudal peduncle, 4 (12.9); length of head, 10.3 (33.2); depth of head directly behind eye, about 5; maxillary, 5.4 (17.4); snout, 2.6 (8.4); eyeball, 2.3 (7.4); interorbital, between soft margin, 1.3 (4.2); postorbital part of head, 7 (22.6); antedorsal distance, 11.7 (37.8); ventral, 8 (25.8); caudal, 8.5 (27.4).

Color.—Body, from base of pectoral, with nine brown crossbars alternated with lighter bars of about same width. Lighter and darker crossbars fairly well delimited on anterior part of body; both rather uniformly pigmented; their edges rather sinuous, not entirely straight. A median series of small brown spots, each spot situated on one of dark bars; the small spots sometimes double, two being sometimes contiguous side by side. Vertical fins and ventral nearly black; pectoral and caudal dusky. Head irregularly sprinkled with brown dots; a couple of small spots in a row on its upper midline.

Holotype.—U.S.N.M. No. 86158. Male. Boca Grande, Fla.; April 2, 1917; taken by steamer *Grampus*.

Remarks.—The type is the only specimen known at present. This species is close to *Gobiosoma ginsburgi* Hildebrand and Schroeder,¹⁶ differing chiefly in the longer ventral and the more depressed head.

¹⁶ Bull. U. S. Bur. Fish., vol. 43, pt. 1, p. 324, fig. 195, 1928.

The color is strikingly different on direct comparison, and this is what first attracted my attention to the type specimen. The anal has one ray less than the great majority of specimens of *ginsburgi*, but since some specimens of the latter species also have 10 rays in the anal, the difference in the number of rays in the anal fin, if any, needs to be worked out by a frequency distribution study of numbers of specimens.

Genus EUCTENOGOBIOUS Gill

Euctenogobius GILL, Ann. Lyc. Nat. Hist. New York, vol. 7, p. 45, 1859.

Genotype.—*Euctenogobius badius* Gill, by monotypy.

In 1859 Gill described a new species of goby, *Euctenogobius badius*, from the Amazon River, based on a single specimen. The above generic name was also introduced there for the first time, and since it contained but this single species, the latter must serve as the type of the genus. The species was described originally as having only one row of teeth in the upper jaw, and on the basis of this single character different species of gobies, of diverse generic types, have been assigned to the genus *Euctenogobius* from time to time by various authors, such as Günther,¹⁷ Jordan and Gilbert,¹⁸ Jordan and Evermann,¹⁹ Meek and Hildebrand,²⁰ and others.

While working in the United States National Museum, comparing the gobies of the coast of the Gulf of Mexico with material from adjacent regions, I came across a jar labeled only *Euctenogobius badius*, "Amazon River" containing one specimen. This is probably Gill's original type, although it does not bear the red "type label." It is well preserved and agrees very closely with the original description in all details of structure and in color. The only important discrepancy is in the length of the head, which Gill states to be "little more than a sixth" of the total length, whereas it is only a little more than a fifth, this difference, most probably, being due to a slip of the pen or to an error in calculation.

An examination of the type specimen shows that it is most closely related to the species now placed in (*Chonophorus*) *Awaous*. It has the general appearance of the species of that genus and agrees with them in the squamation, the structure of the fins, and other characters. Moreover, it has the well-marked fleshy papillae on the shoulder girdle, a structure which is characteristic of *Awaous* and which was not mentioned in the description of the type specimen. In view of the general misinterpretation of this genus, as well as of the inadequate original description, the following account of the species and

¹⁷ Proc. Zool. Soc. London, 1861, p. 372.

¹⁸ U. S. Nat. Mus. Bull. 16, p. 633, 1883.

¹⁹ U. S. Nat. Mus. Bull. 47, pt. 3, p. 2226, 1898.

²⁰ Field Mus. Nat. Hist. Publ. Zool., vol. 15, pt. 3, pp. 874-875, 1928.

genus is rendered in order to align the species with our present-day knowledge of the gobies.

Definition.—Ventrals free, completely united; interspinal membrane present, well developed. Body moderately elongate, scaled. Back in front of dorsal fully scaled, with scales extending to within a short distance back of eyes. Scales of medium size; ctenoid on body as well as on nape and occiput. Opercle and cheek naked. No barbels. Teeth entire, in a single row in upper jaw, in a band in lower jaw. No canines (in female). Shoulder girdle with fleshy papillae. Mouth moderate, maxillary not extending beyond posterior margin of eye. Tongue not emarginate. Pectoral rays all united by membrane. Caudal rounded. The two dorsal fins well separated; the first with six flexible spines, none being filamentous. Second dorsal and anal with an equal and moderate number of rays. No sharp crest nor well-defined keel in front of dorsal. Transverse and lengthwise rows of cutaneous papillae on cheek. Mucous canals present. Anal papilla of female rather large, blunt, subquadrate in preserved specimen, its distal margin finely fimbriate.

Remarks.—This genus is very close to *Awaous*. It is tentatively separated from the latter by the character of the dentition in the upper jaw, the type specimen showing but a single row of teeth in the upper jaw, whereas the species of *Awaous* are generally described as having smaller teeth behind the outer row. However, the availability of this character for generic division in this group of gobies is open to question. Very little is known regarding the variability of the smaller teeth behind the outer row of enlarged teeth in the upper jaw. In some of the species the smaller teeth are very close behind the outer row and being also covered by a thick mucous membrane are hard to observe. Sometimes, in descriptions that appear to refer to the same species, one author may state that the teeth are in one row, while another says they are in more than one row. Such conflicting statements are no doubt mostly due to errors of observation because of the difficulty of the subject matter, as stated; but in some cases it may be due to variability with individual fishes. This question can be settled only by a complete revision of the group and a thorough study of that character. Pending such study it seems best to maintain *Euctenogobius* as a genus distinct from *Awaous*. Eventually, however, it may be found necessary to merge these two genera.

In view of the close relationship and even possible identity of these two genera, a word may be said in regard to the status of the name *Awaous*. Some writers prefer to use the later name *Chonophorus* in place of *Awaous*, contending that the earlier name was originally proposed in the French form and hence unacceptable under the code.²¹

²¹ See Poey, *Memorias sobre la historia natural de la Isla de Cuba*, vol. 2, p. 275, 1860; and Jordan and Eigenmann, *Proc. U. S. Nat. Mus.*, vol. 9, p. 499, 1886.

This contention is evidently not in accordance with all the facts in the case. Cuvier and Valenciennes²² divide the exotic species (from their standpoint) of their large and cumbersome genus *Gobius* into a number of more or less natural groups, which are plainly indicated in the table of contents as well as in the text. All the groups, except the one under consideration, are not supplied with separate names; but for the latter group they state, on page 97 (quarto ed., p. 73), as follows: "On pourrait réunir sous le nom d'*Awaous* un petit nombre d'espèces de gobies qui ont la tête plus allongée . . ." The group is briefly but aptly characterized, and the name is evidently in Latin form. There is no reason why it should not be acceptable under the code. While the genus was established in a somewhat noncommittal manner, yet the authors introduced a new name in scientific nomenclature, and the manner of its introduction is not different from some other generic names which are at present recognized. The group of gobies thus named *Awaous* included originally *ocellaris*, *nigripinnis*, *pallidus*, *guamensis*, *banana*, and *martinicus*. Later, Bleeker²³ designated its type as *Gobius ocellaris*. The name *Awaous*, 1837, which antedates both *Euctenogobius* and *Chonophorus*, is therefore valid, with *Gobius ocellaris* as its type species by subsequent designation.

EUCTENOGOBIUS BADIUS GILL

Euctenogobius badius GILL, Ann. Lyc. Nat. Hist. New York, vol. 7, p. 47, 1859.

Description of type.—D. 6–11. A. 11. Scales 55–13½. The body has markedly the aspect of a specimen of similar size in the United States National Museum, labeled *Chonophorus taiasica*. Mouth moderately oblique, low, terminal, a horizontal line through margin of upper jaw about bisecting cheek below eye. Lower jaw rather thin and narrowly rounded in front, almost angular, very slightly included. Maxillary reaching a vertical slightly past middle of eye. Snout broad and rounded, its profile suggesting the quadrant of a circle. Eye placed high, its upper margin about on the line of the profile. Squamation quite similar to the species of *Awaous*. Longitudinal rows of scales on body markedly regular; 55 oblique rows from upper angle of pectoral to base of caudal, 50 rows when counted on midline from base of pectoral, 13½ scales in an oblique row from origin of anal to base of second dorsal; 17 longitudinal rows from midline of belly, in front of vent, to back. Back in front of dorsal fully scaled; the scales extending nearly but not quite to the eyes, finely ciliated like those on body, gradually growing smaller anteriorly. No scales on cheek and opercle. Some small, partly embedded scales on base of pectoral and similar scales on chest. Belly scaled except a small area on midline directly behind ventrals. Teeth in upper

²² Histoire naturelle des poissons, vol. 12, 1837.

²³ Arch. Néerland. Sci. Nat., vol. 9, p. 320, 1874.

jaw, rather large, pointed, slightly recurved, close-set, in a single row. (An examination with a binocular microscope after the preserving liquid was removed with filter paper showed no trace of smaller teeth behind the outer row, and they are most probably not present. There is a possibility that minute teeth are embedded in the thick mucous membrane, but this could not be determined more definitely without injury to the specimen.) Teeth in lower jaw smaller than in upper, subequal, in a narrow band, about four rows at symphysis, tapering off to a single row at angle of mouth, the band interrupted at symphysis by a narrow bare space. Tongue with a wide truncate margin in front, not emarginate. Three short fleshy flaps on shoulder girdle. Anal papilla broad, subquadrate, and rather flat in preserved specimen, its distal margin finely fimbriate, in appearance similar to that of females of *Awaous*. The two dorsal fins well separated, none of the spines of the first dorsal notably filamentous, not reaching origin of second dorsal when laid back. Origin of anal slightly behind that of second dorsal, both fins ending on nearly the same vertical, their posterior rays not reaching base of caudal when laid back; 11 rays in both fins (the first unbranched ray included and the last two which are approximate at their base being counted as one). Ventral ends well in advance of vent. Bases and tips of ventral and pectoral nearly on same verticals. Caudal fin not prolonged.

The cutaneous papillae and mucous canals may be described as follows, in so far as they be observed by a microscopic examination without treating the specimen with special reagents: 5 transverse rows under eye, the first one rather oblique, the others more or less vertical, the last one incomplete; 2 longitudinal rows on cheek, the upper at about middle of cheek extending from fourth transverse row to margin of preopercle, the lower extending from first to fourth transverse rows, anteriorly curving along outline of upper lip, posteriorly horizontal; a broadly curving row of papillae along angle of preopercle extending below to articulation of mandible and continued with some interruption along inner edge of lower jaw; 2 transverse rows on opercle, one near either margin, connected by a horizontal row not far from lower margin; a transverse row directly behind eyes, continued horizontally backward at level of middle of eye, to base of pectoral; a broadly V-shaped row forward from upper to lower nostril and backward to upper lip; a short lengthwise row connecting lower end of latter with middle of first transverse row under eye; a short row on inner side of upper nostril parallel to upper profile; a horizontal mucous canal along upper edge of opercle to middle of eye, thence curving along upper edge of eye to a conspicuous pore located at about end of anterior third of eye, where what appears like a short cross mucous channel connects the two from the opposite sides; mucous channels on snout not easily followed without special treatment; a transverse mucous canal along vertical edge of preopercle.

Measurements.—Total length, 82.5. Standard length, 67. Greatest depth (abdomen pressed to approximately normal position), 12.5 (18.7); depth of caudal peduncle, 6.8 (10.2); length of head, 17.2 (25.7); maxillary, 8.1 (12.1); snout, 6.4 (9.6); eye, 4.6 (6.9); interorbital, bony part, 1.2 (1.8); postorbital part of head, 9 (13.4); antedorsal distance, 23 (34.3); caudal, 16 (23.9); ventral, 15 (22.4) distance ventral to anal origins, 21 (31.3); base of anal, 18 (26.9); base of second dorsal, 19.5 (29.1). Some of the measurements given in the original description remeasured and restated are as follows: Depth, 6.6; head 4.8; caudal, 5.2 in total length; height of head behind eye about equal to its width 1.7 in its length.

Color.—The color is still fairly well preserved. The body is a warm cocoa brown with light-colored longitudinal streaks following regularly along the rows of scales, the streaks being made up of light dots, one on each scale. The head is clouded with plumbeous. The caudal is still faintly barred. The other fins are now nearly uniformly brown.

Type.—The type, described above, comes from the Amazon River and bears U.S.N.M. No. 6091.

CROSSOCHIR KOELZI: A NEW CALIFORNIAN SURF-FISH OF THE FAMILY EMBIOTOCIDAE

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In the preparation of a monographic review of the fishes of the family Embiotocidae—the viviparous perches of the North Pacific—it has become evident that one of the most distinct species of the California coast has remained unnamed. The characters of this form are, however, so clear that a new genus appears needed for its sole reception.

This form has only once been distinguished. In my 1918 revision of the family, it was keyed out as *Holconotus rhodoterus*, which among previously named forms is probably its closest relative. In preparing that revision, I had specimens of *Crossochir* but none of the true *Holconotus* at hand, and so rather naturally made the misidentification, no more suspecting than did Dr. David Starr Jordan or other ichthyologists that an unnamed species existed in this well-studied family.

The distinguishing features of *Crossochir koelzi*, the new genus and species, and of other members of the subfamily Amphistichinae are indicated in the following key:

KEY TO THE GENERA AND SPECIES OF THE EMBIOTOCID SUBFAMILY AMPHISTICHINAE

- a*¹. Anal fin of breeding male without definite horny excrescence and huge flasklike gland, but with one ray (about the twelfth, at the angle in the fin base) enlarged and ossified into a strong triangular plate with serrated edge, and with the next ray following also somewhat strengthened (in the female the homologous rays are somewhat modified in the same direction, sufficiently so for purposes of identification). No oval depression on body near front of anal fin. No sexual variation in number of fin rays or vertebrae. Spinous portion of dorsal shorter than the soft part. Teeth unicuspid, in two series in each jaw (the inner row of lower jaw more or less confined to front of jaw). (Subfamily Amphistichinae.)

- b*¹. Lower lip with posterior groove continuous across chin. Mouth decidedly oblique, rising to opposite lower part of eye anteriorly.

- c*¹. Dorsal spines rather slender and weak, abruptly graduated to the long middle spines, behind which the margin of the fin is nearly straight. Anterior interneurals not greatly strengthened, with low and blunt lateral ridges. Pectoral fin longer, with upper edge nearly straight to tip, and lower rays only slightly frayed and silky. Fins pale, with or without black markings.
- d*¹. Lower jaw very strong, projecting forward at the symphysis beyond the upper, so that the teeth of the two jaws are far from being opposed. Body more nearly oblong (depth about two-fifths standard length). Anal fin relatively short, with fewer than 25 soft rays.
- e*¹. Gill rakers long and numerous (about 20 below angle). Mouth strongly oblique. Vertebrae 32 (15 + 17), of which only 11 support anal base. Dorsal and ventral contours about equally curved. Body rather strongly compressed.
- f*¹. Eye little enlarged (about one-fifth length of head). Anterior ventral edge not sharpened or strongly curved. Color: Sides not barred; pelvic fins plain; anal with a black blotch----- *Hypocritichthys analis*
- d*². Lower jaw less prominent; the teeth of the two jaws nearly opposed. Body more rounded and deeper (depth about half standard length). Anal fin longer, with more than 28 soft rays.
- e*². Gill rakers relatively long and numerous (more than 15 below angle). Mouth excessively oblique. Vertebrae 33 to 35, of which 12 to 14 support the anal base. Dorsal contour somewhat less strongly curved than the ventral. Body very strongly compressed.
- f*². Eye excessively enlarged (about two-fifths length of head). Gill rakers longer, and more than 20 below angle of first arch. Anterior ventral edge blunter and less strongly curved. Color: Sides occasionally faintly barred; pelvic fins black distally; anal without black edge or blotch----- *Hyperprosopon argenteum*
- f*³. Eye moderately enlarged (about one-third length of head). Gill rakers shorter; fewer than 20 below angle of first arch. Anterior ventral edge rather sharp and very strongly and evenly curved. Color: Sides rather faintly barred; pelvic fins plain; anal fin with an inky-black margin----- *Tocichthys ellipticus*¹
- e*³. Gill rakers relatively short, thick and few (only 11 to 13 below angle). Mouth only moderately oblique. Vertebrae 32 (14 + 18), of which only 11 support the anal base. Dorsal and ventral contours about equally curved. Body less strongly compressed.
- f*⁴. Eye smaller. Anterior ventral edge blunt and not very strongly curved. Color: Sides rather strongly barred; fins without black markings, but reddish (especially the caudal)----- *Holconotus rhodoterus*

¹This is the species previously called *Hyperprosopon agassizii*. On its nomenclature, see Hubbs (1918 and 1928). The supposed difference in dentition, pointed out in the original diagnosis of *Tocichthys*, does not hold well.

- c*². Dorsal spines extremely robust and much shorter than the dorsal rays; margin of spinous fin rather evenly rounded. Anterior interneurals very strong, with sharply expanded lateral keels. Pectoral fin shorter and with upper margin strongly curved downward toward tip, so that the fin is more nearly symmetrical than in any other embiotocid; lower rays of pectoral more frayed and silky than in any other genus. Fins mostly dusky (in preservative; probably deep red in life).
- d*³. Lower jaw not very prominent; the teeth of the two jaws opposed. Body deep (depth about half standard length). Anal fin rather long, with 25 to 31 soft rays.
- e*⁴. Gill rakers moderate in length and number (14 to 17 below angle). Mouth only moderately oblique. [Vertebrae not examined.] Dorsal contour much more strongly curved than the ventral. Body not very sharply compressed.
- f*⁵. Eye moderate (about one-fourth length of head). Anterior ventral edge blunt and but little curved. Color: Body speckled, with trace of bars; fins without black markings----- *Crossochir koelzi*
- b*³. Lower lip with the posterior groove interrupted by a broad frenum. Mouth little oblique, not rising to opposite eyes anteriorly.
- c*⁴. Dorsal spines, spinous dorsal, and interneurals intermediate between those of groups *c*¹ and *c*². Pectoral fin as in *c*¹. Fins pale.
- d*⁴. Lower jaw and teeth as in *d*³. Body rather slenderer, distinctly less than half as deep as long. Anal fin averaging shorter, with about 25 soft rays.
- e*⁵. Gill rakers short and few, as in *Holconotus*. Mouth very weakly oblique. Vertebrae 29, of which only 10 support the anal base. Dorsal contour somewhat more strongly curved than the ventral. Body relatively thick.
- f*⁶. Eye rather small. Anterior ventral edge blunt and little curved. Color: Strongly though irregularly barred; fins without black markings... *Amphistichus argenteus*

CROSSOCHIR, new genus

The characters of this genus are those given successively in items *a*¹, *b*¹, *c*², *d*³, *e*⁴, *f*⁵, of the preceding key. Its relationships appear to be most intimate with *Holconotus*, though it is almost equally close to *Amphistichus*. From the latter it differs trenchantly in lacking the frenum, and is further distinguished by the more oblique mouth and deeper body, and usually by the longer anal fin. It differs from *Amphistichus* weakly, and from *Holconotus* more decisively, in the stronger and lower dorsal spines, more rounded spinous dorsal, and stronger and more keeled interneurals. From both *Amphistichus* and *Holconotus*, as well as other genera, it differs in having the pectoral fin shorter, with more arched upper edge and

frayed and silky lower rays. From those two genera *Crossochir* differs further, though not very trenchantly, in having the gill rakers somewhat longer and more numerous, approaching those of the remaining genera of the Amphistichinae. In addition to having shorter and fewer gill rakers, *Crossochir* also differs from these other genera in the dorsal spine and interneural characters, as well as in other respects. The color of the type species gives *Crossochir* a distinctiveness of appearance sufficient for quick identification.

The type and only known species is *C. koelzi*, herein described.

The name *Crossochir* (fringed hand) refers to the frayed and silky lower pectoral rays.

CROSSOCHIR KOELZI, new species

PLATE 1

Holconotus rhodoterus YARROW and HENSHAW, 1878, p. 205 (Santa Barbara record not checked); BEAN, 1880, p. 88 (San Diego record not checked; Santa Cruz Island and Santa Barbara records checked); JORDAN and GILBERT, 1881a, p. 456 (Monterey Bay and Santa Barbara records checked); JORDAN and JOUY, 1881, p. 10 (Monterey and Santa Barbara records checked); JORDAN and GILBERT, 1881b, p. 50 (Santa Barbara record checked; Tomales and Soquel records may also apply to this species); EIGENMANN, 1892, p. 156 (San Diego, in surf; record not checked); EIGENMANN and EIGENMANN, 1892, p. 354 (San Diego record not checked; Santa Barbara and Monterey records checked); GILBERT, 1895, p. 466 (San Simeon Bay record, checked by Myers); HUBBS, 1918, p. 12 (diagnosis, in key).

Amphistichus rhodoterus EIGENMANN and EIGENMANN, 1890, p. 9 (San Diego record not checked; life colors).

In recording this species repeatedly under the name of *rhodoterus*, none of the authors quoted indicated any doubt in the identification. An examination of the synonymy of *Holconotus rhodoterus* (and of other embiotocids), as given by Eigenmann and Ulrey (1894, p. 388) and by Jordan and Evermann (1898, p. 1502) gives no indication that a name has ever been proposed for the present species. *Cymatogaster pulchellus* and *C. larkinsii*, as nearly as can be told from the original diagnoses by Gibbons (1854), are based on the true *Holconotus rhodoterus* Agassiz. All three nominal species were described from San Francisco, where *rhodoterus* is common.

Another quoted synonym of *Holconotus rhodoterus*, *Cymatogaster ellipticus* (Gibbons, 1854), is clearly the species later called *Hyperprosopon* or *Tocichthys agassizii*, as I have already indicated (1928, p. 12). On the other hand, *Embiotoca* or *Ennichthys heermanni* Girard, from Cape Flattery, should certainly be restored to the synonymy of *Holconotus rhodoterus*. It was properly so placed until 1890, when Eigenmann and Eigenmann transferred the name to the synonymy of *Amphistichus argenteus*, presumably because their "*Holconotus rhodoterus*" was another species (*Crossochir*

koelzi). This false synonymy, persisting until my correction in 1928, gave rise to a bad error in statement of ranges: *Holconotus rhodoterus* was said to range northward only to San Francisco, whereas it is abundant along the surf of Oregon and Washington, and *Amphistichus argenteus* was said to range northward to Cape Flattery, whereas there are no authentic records north of San Francisco.

The range of *Crossochir koelzi*, as determined from the literature records and from the type specimens, is central and southern California, from Drakes Bay to San Diego, and thus approximately coincides with that of *Amphistichus argenteus* and overlaps that of *Holconotus rhodoterus* about San Francisco. So far as checkable, all records of *H. rhodoterus* from south of San Francisco were based on *Crossochir koelzi*. What little is recorded as to its habitat indicates that this species, like its nearest relatives *Holconotus rhodoterus* and *Amphistichus argenteus*, is essentially an inhabitant of the surf, ordinarily penetrating the bays only to their more open portions.

Specimens examined.—Holotype: U.S.N.M. No. 26901, a specimen 198 mm long to caudal, collected by Jordan at Santa Barbara, Calif., in 1880.

Paratypes in National Museum, 135 mm to 208 mm to caudal: Another specimen from the holotype lot; No. 26933, 3 specimens, same data; No. 27074, Monterey, Calif., Jordan, 1880; No. 47110, Santa Cruz Island, Calif., seined, *Albatross*, 1889; No. 54726, Drakes Bay, Calif., *Albatross*.

Paratype in Museum of Comparative Zoology: One adult female, 186 mm long, collected in California by A. Agassiz.

Paratype in Scripps Institution of Oceanography: One adult female, 210 mm long, collected by Percy S. Barnhart in the surf at La Jolla, Calif., in the spring of 1926. Another specimen from La Jolla is in the same institution, according to Mr. Barnhart.

Paratypes in Field Museum of Natural History: No. 7618, 3 specimens 132 to 175 mm long, from San Diego, Calif.

Paratypes in Museum of Zoology, University of Michigan: No. 64225, one half-grown female, 107 mm long, Santa Cruz Island, Calif., seined, *Albatross*, 1889; No. 95030, Scripps Institution Pier, La Jolla, Calif., collected by Percy S. Barnhart in April, 1927.

Specimens (not paratypes) in Stanford University collection (identifications kindly furnished by George S. Myers): No. 2726, five from Santa Cruz Island, Calif.; No. 5364, one from San Simeon Bay, Calif.

Appreciation is expressed to the authorities of the several institutions just named for permission to use their material of this new species as the basis for the present paper.

Description, based on the holotype and all paratypes (counts and measurements of paratypes given in parentheses).—The body is rather deep; depth, not including dorsal sheath, 1.8 (1.8 to 2.1). It is moderately compressed; width, 3.4 to 3.7 in depth. The least depth of the high and thin caudal peduncle is contained 1.7 to 2.2 times in the head. The caudal peduncle is almost twice as deep as its length measured on midline behind vertical from end of anal base. The dorsal contour is decidedly more sharply curved than the ventral; as a whole, it is a high, even arch, but is gently concave in the nuchal region.

The head is a thick, blunt, almost symmetrical cone as seen from the side. The mouth, moderately oblique, rises to opposite lower part of eye. The eye is of moderate size, and the interorbital moderately convex. Length of head, including opercular membrane, 3.4 (3.2 to 3.5) in standard length. Least fleshy interorbital width, 3.6 (3.2 to 4.3) in head; least suborbital width, 2.4 (2.1 to 3) in orbit; greatest diameter of orbit between rims, 3.7 (3.5 to 4.1) in head; length of upper jaw, 2.7 (2.65 to 2.9).

The teeth are in two rows in the upper jaw (sometimes so irregular backward as to appear to form three rows; sometimes uniserial at extreme end of band). In the lower jaw, the teeth are biserial in front, but become irregularly uniserial on the sides. The teeth in the outer row in each jaw are considerably enlarged, somewhat curved, scarcely incisorlike.

The gill rakers are of moderate length and number. The longest is contained 1.7 (1.6 to 2.2) times in the orbit. The number on the first arch is 9 (6 to 8) + 16 (14 to 17) = 25 (21 to 23).

Scales, 66 (61 to 68) in lateral line to end of hypural; $6\frac{1}{2}$ ($7\frac{1}{2}$ in one) rows between middle of sheath along first dorsal and lateral line; 22 (20 to 24) in a series from origin of anal to lateral line.

Dorsal rays XI (X or XI, usually X), 26 (24 to 28); anal rays III, 29 (25 to 31); principal caudal rays 14 (outer pair unbranched; 13 in one); pectoral rays, 26 (25 to 29).

The spinous dorsal is relatively low and rounded. The first four spines are short, and graduate rather slowly and evenly; the fifth to seventh are subequal (the sixth rarely considerably the longest); the following spines are progressively shortened. The heteracanthous dorsal spines are very strong, and as a consequence the supporting interneurals are also much strengthened, and produced outward as sharply expanded keels. The soft dorsal is almost straight-edged (slightly convex to slightly concave). The first soft ray is about one-third higher (rarely scarcely higher) than the highest spine, which, measured from the top of the scaly sheath, enters the head 2 (1.8 to 2.9) times.

The caudal fin is wide, with the lobes not sharply pointed. The inner edge of the shortest ray is contained 1.65 (1.5 to 1.8) times in length of longest ray. The strong caudal rays are almost fan-shaped.

The characteristic pectoral fins are a little shorter than the head (rarely as long), and have the upper edge arched (sometimes not very strongly); the tip more rounded than in related species and the lower edge nearly straight. The lowermost several rays are weak and frayed out to a rather silky fringe, almost as in *Gobius* (in some specimens this modification is less evident than in others, and an approach in the same direction is shown by related species).

The pelvic fins do not quite extend to the origin of the anal in the female, but slightly pass this point in the males.

The anal fin of the male shows to a well-developed degree the modifications characteristic of the Amphistichinae. In this sex the anterior rays form a lobe that is considerably lower than the posterior part of the fin. The several posterior rays of this lobe are considerably thickened about one-third the way out and again near the edge of the fin. In these thickened portions, the articulations of the rays are increased in size and distinctness, whereas elsewhere on these rays the articulations are almost fused. This modification becomes exaggerated toward the posterior end of the lobe. Located at the angle between the two lobes of the fin, one soft ray, the tenth to fourteenth, is grossly exaggerated to form a triangular plate. This is made up of the many branches of the ray, largely fused, and spread out to form a somewhat sawlike edge. The somewhat thickened anterior edge of the plate underlies a fleshy ridge, which becomes enlarged to form a well-marked lobe near the fin margin. Just anterior to this lobe, and just within the outer thickened portions of the rays, another dermal thickening is developed. The posterior edge of the triangular plate is expanded outward and backward on each side, medially, to form a rough-edged bony lobe. The ray next following the one modified into the plate is also considerably widened and somewhat thickened, and has a serrated lobe on both edges on each side. The next following ray is normal in structure, but is a little wider than those that follow. All these secondary sexual modifications of the anal fin are shown to a small degree by the females. In that sex the anterior rays are not shortened as in the male but form a convex lobe, which is set off by only a shallow emargination from the much straighter posterior portion of the fin. The highest anal ray in the female is contained 2.8 (2.6 to 3.3) times in the head.

In alcoholic specimens the body is silvery, with numerous small, scattered, brown flecks, deeper than long, producing an effect somewhat resembling *Eupomotis*. Many of the spots are paired, and

these doubled spots are roughly aligned vertically to form a definite suggestion of narrow bars. Some specimens show a trace of three rows of small blotches, each row parallel with the dorsal contour. The fins become dusky to blackish outward, but show no definite black markings.

The life colors of what was almost certainly an example of this species from San Diego were thus described by Eigenmann and Eigenmann (1890, pp. 9-10):

Silvery, the body profusely covered from dorsal to anal and ventral fins, with squarish, bronze spots, the color being exactly like that which forms bars and spots on *A. argenteus*, except that the brassy color in *argenteus* is modified only by black dots, while in *rhodoterus* the brassy color is modified by both black and scarlet dots, the scarlet making the sides appear to be strongly tinged with red. The brassy ground color of the spots is not resolved into dots by the aid of a pocket lens, but appears as if evenly applied, and the red and black dots sprinkled upon it. Dorsal surface backward to insertion of dorsal fin, olive; a blue metallic reflection above lat. line from nape backward. Ventral surface backward to base of ventrals strongly scarlet tinged, the red and black dots aggregated on the breast to form crescents parallel with the scale margins; premaxillary posteriorly, and maxillary, cheeks and opercles also strongly red tinged, this region and the breast appearing, at a glance, to be "bloodshot."

All the fins, except the pectoral, blackish at tips and reddish tinged; an olive streak through the dorsals which is most conspicuous anteriorly. Pectorals reddish at base, otherwise plain and slightly olivaceous.

Percy S. Barnhart, of the Scripps Institution of Oceanography, writes that the specimen he collected at La Jolla had in life almost exactly the color of *Amphistichus argenteus*.

This species is dedicated to the well-known explorer Walter Koelz, in recognition of his studies on the American coregonid fishes.

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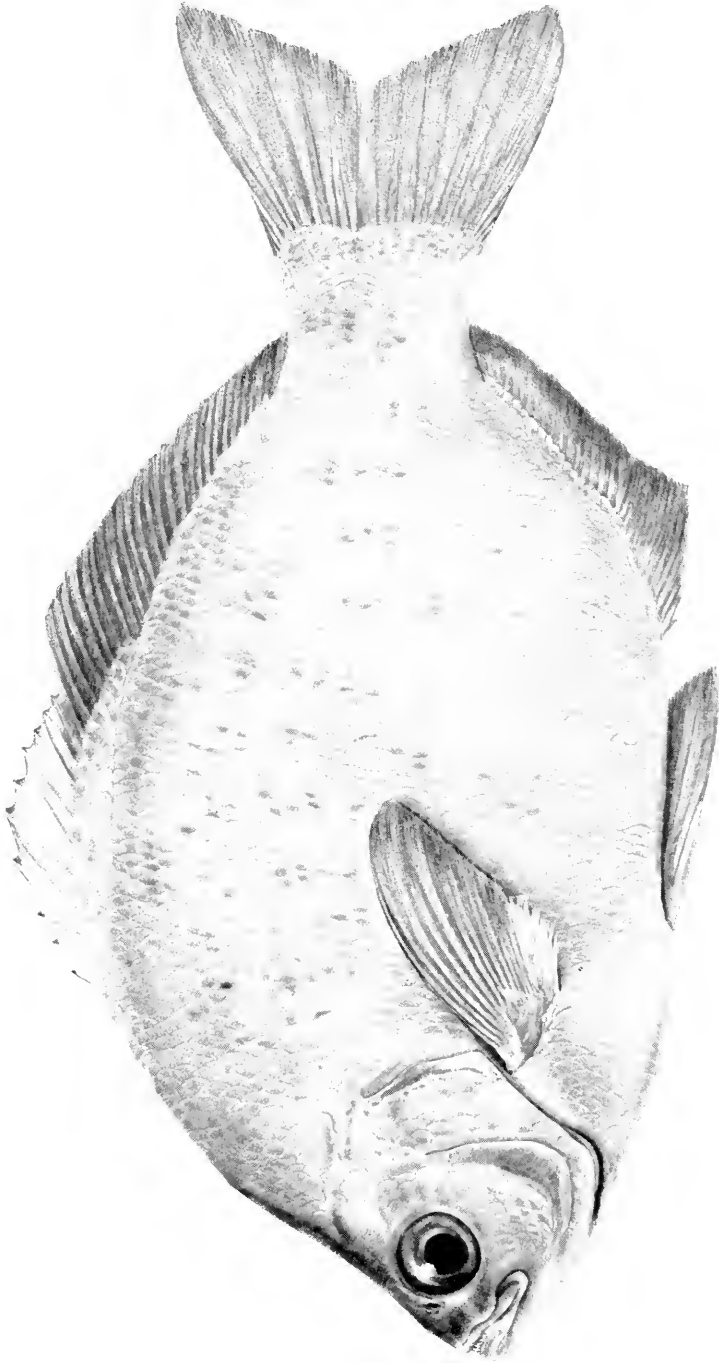
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CROSSOCHIR KOELZI, NEW GENUS, NEW SPECIES

From a paratype 186 mm long. An adult female collected by the Scripps Institution of Oceanography in the surf at La Jolla, Calif. Drawn by Grace Eager.

POTTERY OF THE HOPEWELL TYPE FROM LOUISIANA

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INTRODUCTION

It is significant that pottery vessels similar to a type recognized in the upper or northern Mississippi Valley as belonging to the Hopewell Indian culture have been found in the east-central part of Louisiana, near Marksville. This paper, which includes a detailed description and a comparative study of the pottery from Marksville, may offer a clue regarding the migration and development of the northern Hopewell culture.¹

The pottery and associated artifacts herein described were excavated by the late Gerard Fowke during his archeological explorations in the Red River Valley of Louisiana, February to May, 1926 (figs. 1 and 6). No illustrations or detailed descriptions appear in his final report,² though in the preliminary report³ a few specimens were figured.

Further evidence was obtained by Dr. John R. Swanton at the Marksville works while making an ethnological reconnaissance in Louisiana during July, 1930. In examining the unfinished trench dug by Fowke⁴ in Mound 4, portions of two decorated vessels were recovered, and numerous potsherds similar to those found by Fowke, which closely resemble the typical Hopewell decoration.

Analyzing the restored vessels from Mounds 4 and 8, we find: The vessel on Plate 1 can be considered typically Hopewell, because of such features as the cross-hatched band and bisected cones just beneath the rim; the decoration consisting of smooth bands outlined by incised grooves; the roughened area outside the bands; the conventionalized eagles; and the four lobes.

¹ For a detailed description of Hopewell characteristics, see MILLS, W. C., and SHETRONE, H. C., *Exploration of Hopewell group. Certain mounds and village sites in Ohio*, vol. 4, pt. 4, pp. 297-305, 1926.—SHETRONE, H. C., *Culture problem in Ohio archeology*. *Amer. Anthrop.*, new ser., vol. 22, no. 2, pp. 144-172, 1920.—SHETRONE, H. C., and GREENMAN, E. F., *Explorations of the Seip group of prehistoric earthworks*. *Ohio Arch. and Hist. Quart.*, vol. 40, no. 3, pp. 343-509, 1931.—McKERN, W. C., *Wisconsin variant of the Hopewell culture*. *Bull. Public Mus. City of Milwaukee*, vol. 10, no. 2, pp. 228-241, 1931.

² Fowke, G., *Explorations in the Red River Valley in Louisiana*. 44th Ann. Rep. Bur. Amer. Ethnol., pp. 405-434, 1928.

³ Fowke, G., *Archeological work in Louisiana*. *Smithsonian Misc. Coll.*, vol. 78, no. 7, pp. 254-259, 1927.

⁴ Fowke, G., 44th Ann. Rep. Bur. Amer. Ethnol., p. 421, pl. 68, b, 1928.

The lower half of the vessels on Plate 2, A and B, has been decorated in much the same manner as the figure outlined on the four lobes of Plate 1. The figures on the upper half of the vessels bear no resemblance to those on the other vessels, yet the method of decoration is precisely the same as that on the lower half.

The manner of outlining by deeply incised grooves and the zig-zag roughening on the vessel shown on Plate 2, C, bears resemblance to the aforementioned three vessels. The band of decoration below the rim on this vessel is radically different from the typical Hopewell, yet it is closely comparable to the band around the neck of the vessel on Plate 3, C. This latter jar has slightly incised parallel lines running at a 45° angle, which may represent the unfinished cross-hatched design found on the typical Hopewell jars.

The vessel shown on Plate 3, B, has the characteristic smooth bands outlined with grooves, while the rest of the surface is roughened. Instead of the typical cross-hatched and punctate design below the rim, this vessel has only the line of punctations or bisected cones, while the area usually cross-hatched is smooth.

The two jars (pl. 3, C and D) differ most radically from the rest of the vessels as well as from the typical Hopewell. Jar C has the beginning of what appears to be the cross-hatched design below the rim, but the area around the neck is similar only to the design on the vessel shown on Plate 2, C. The design around the neck, however, and the fact that it was found associated with vessels from Mound 4 would be sufficient evidence to show that it belongs to the same culture though embodying an entirely different method of decoration, that is, the concentric grooves with narrow polished bands between.

The method of decorating vessels by the concentric or close-spaced incised grooves is at variance with the typical Hopewell, and yet the miniature vessel shown on Plate 3, D, which embodies this technique, clearly shows two conventionalized eagles facing each other. This conventionalization certainly resembles the decoration on Plates 1 and 2, A and B.

Figures C and D on Plate 4 are the only ones on that plate that show any resemblance to the aforementioned vessels. The method of decoration on vessel C, Plate 4, approximates the decoration on typical Hopewell vessels, while the fragmentary vase is similar to the two vessels on Plate 3, C and D.

This analysis indicates that the decorations on all the vessels from Mounds 4 and 8 of the Marksville works show a definite relationship to one another and that the decoration on some of them is analogous to the characteristic designs on vessels from the Hopewell culture in the upper Mississippi Valley.

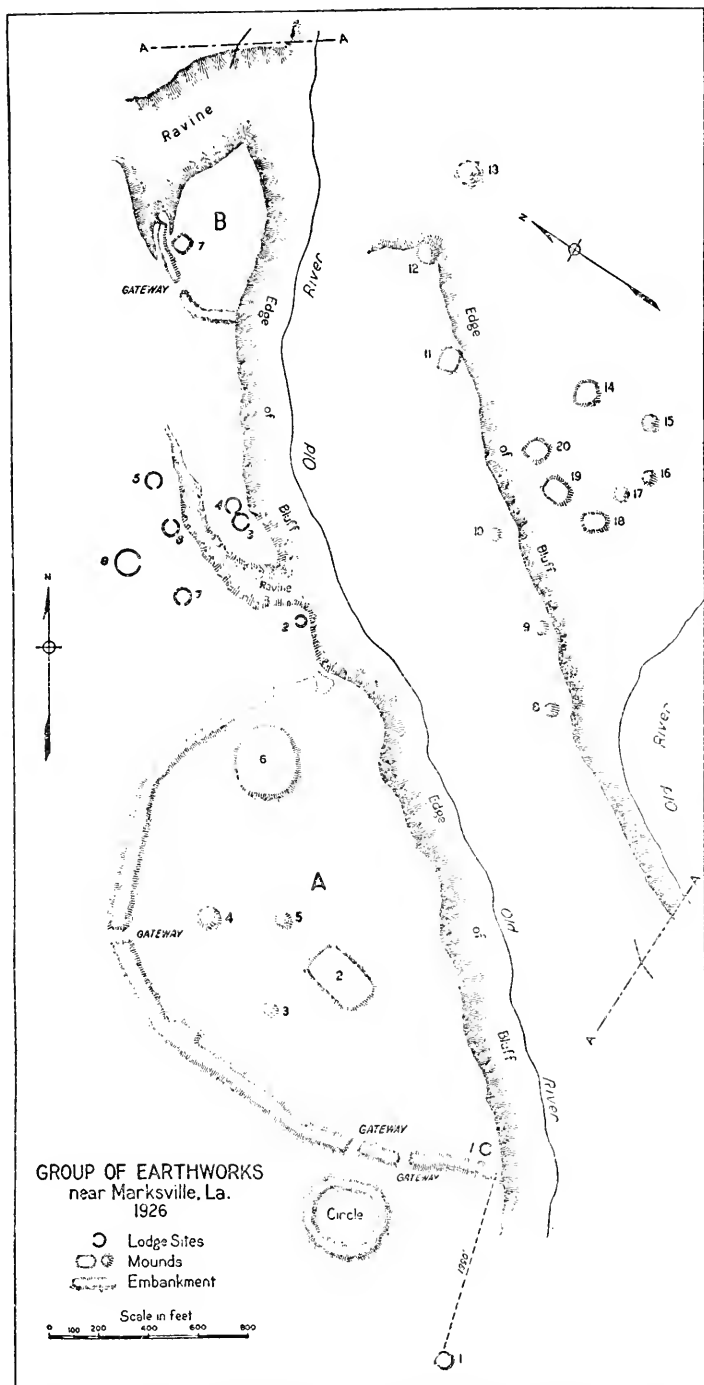


FIGURE 1.—Plan of the Marksville works (after Fowke). Lines A—A should be superimposed in order to place Mounds 8 to 20 in their respective positions

POTTERY FROM RECOGNIZED HOPEWELL SITES

In order to determine the dominant characteristics of Hopewell pottery, Table 1 has been made to show the decorated vessels and sherds illustrated and described in various publications⁵ dealing with the excavation of mounds in the upper Mississippi Valley reputed to have been built by Indians possessing the Hopewell culture. Four Hopewell pottery vessels from Ohio are illustrated on Plate 7. The table should indicate the outstanding characteristics of the pottery illustrated from these sites. If we allow for the incompleteness of the table, due to the fact that only the vessels and sherds that have been illustrated are considered, it seems obvious that the most outstanding feature of the decoration on the upper Mississippi Hopewell vessels and sherds is that the decoration on 31 have bands of various dimensions outlined with deeply incised grooves, the areas between or outside these grooves roughened uniformly either by roulette, zigzag, punctate, or cord marks. Nineteen of the illustrations show that the area just below the rim—in the case of jars—has been decorated with incised cross-hatched lines and an encircling line of bisected cones. The dominant tempering material is grit, the one exception being a vessel from the Mound City group described by Mills as having shell tempering. The forms vary: 12 bowls, 11 jars, and 2 vases. There are five examples of supporting feet. Seven jars are shaped with four lobes—the predominant style—one with six, and one with three. No vessels or sherds are illustrated or described with handles. Twelve have round, seven pointed, and five flat bases. No applied pigment is used for decoration.

How do the vessels and potsherds from Mounds 4 and 8 in the Marksville works compare with these? With regard to the decoration, 9 of the 12 restored vessels have bands outlined with deeply

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- ⁵ 1. Turner group of earthworks: Willoughby, C. C., *Papers Peabody Mus. Amer. Arch. and Ethnol.*, Harvard Univ., vol. 8, no. 3, pp. 1-98, 1922.
2. Hopewell Mound group of Ohio: Moorehead, W. K., *Field Mus. Nat. Hist. Publ. Anthropol.*, vol. 6, no. 5, pp. 75-178, 1922; Mills, W. C., and Shetrone, H. C., *Certain mounds and village sites in Ohio*, vol. 4, pt. 4, pp. 79-305, 1926.
3. Mound City group: Mills, W. C., *Certain mounds and village sites in Ohio*, vol. 3, pt. 4, pp. 245-406, 1922; Squier, E. G., and Davis, E. H., *Ancient monuments of the Mississippi Valley*, *Smithsonian Contr. to Knowl.*, vol. 1, pp. 187-190, pl. 46, 1848.
4. Tremper mound: Mills, W. C., *Certain mounds and village sites in Ohio*, vol. 2, pt. 3, pp. 105-240, 1917.
5. Edwin Harness mound: Mills, W. C., *Ohio Arch. and Hist. Quart.*, vol. 16, no. 2, pp. 113-193, 1907.
6. Seip Mound No. 1: Shetrone, H. C., and Greenman, E. F., *Ohio Arch. and Hist. Quart.*, vol. 40, no. 3, pp. 343-509, 1931.
7. Seip Mound No. 2: Mills, W. C., *Ohio Arch. and Hist. Quart.*, vol. 18, no. 3, pp. 269-321, 1909.
8. Wisconsin variant of the Hopewell culture: McKern, W. C., *Bull. Public Mus. City of Milwaukee*, vol. 10, no. 2, pp. 185-328, 1931.

TABLE 1.—Hopewell pottery illustrated in various publications (see footnote 5, p. 4)

GROUP	FORM						BASE				TEMPER			DECORATION											
	3-lobed	4-lobed	6-lobed	Bowls	Jars	Vases	Unique	Handles	Pointed	Round	Flat	Feet	Grit	Shell	Potsherds or clay	Incised cross-hatched lines and punctate below rim	Parallel grooves terminated by groups of dots	Smooth or rough-lined bands outlined by incised grooves	Concentric grooves and narrow bands	Roulette	Zigzag	Punctate	Cord-marked	Painted	
1. Turner.....		1			3	1			3	7		1	1			3		7		2	7	1			
2. Hopewell.....					1	1				1		1	1			3		5			3				
3. Mound City.....	2			2	3				1	2		2	1				3		1			1			
4. Tremper I.....																									
5. Edwin Harness.....																									
6. Seip No. 1.....					3				1	2		1	3			4		5			1	3			
7. Seip No. 2.....																3		2							
8. Wisconsin variant.....	1	4		10	2				4	3						6		9				4			
Total.....	1	7	1	12	11	2	0	0	7	12	5	5	7	1	0	19	0	31	1	4	19	2	4	0	
9. Marksville.....	1			4	3	4	1			11					16	4	2	9	3	3	2	1			

1 No illustrations.

incised grooves. Either the bands or the remaining parts of the vessel were roughened uniformly; on three specimens by means of the roulette, three by concentric grooves or bands, two by means of zigzag lines, and one by the punctate method. In four cases the area just below the rim of the jars is decorated with cross-hatched incised lines and the encircling line of bisected cones. Thus far a similarity is obvious. However, the tempering used in the Marksville pottery differs radically from that common to the northern Mississippi type. In the former case either pulverized potsherds or small particles of hard clay are used; in the latter, grit or shell. The base of all the Marksville vessels so far as could be determined was flat. As to form, four of the Marksville vessels are bowls, four vases, three jars, and one unique in shape. Only one is 4-lobed.

Comparison between the Marksville and Hopewell wares shows a close similarity, while in the case of Plate 1 we have a vessel identical with the Hopewell type. Independent invention of so complicated a technique of decoration where there is such striking similarity would seem improbable. Either the pottery was carried into the South by the northern Hopewell Indians themselves or else it reached the region through trade. Definite evidence of contact between the North and the South is found in the northern Hopewell mounds. This consists of tortoise shells, barracuda jaws, and other articles from the Gulf. On the other hand, the Hopewell Indians and their characteristic culture could have originated in the South and spread or migrated to the northern Mississippi States. The former would imply a northern origin for the decorative technique; the latter, a southern. If the latter hypothesis were true, we should expect to find a relationship between this technique and other southern pottery decorations. This point will be considered later. Also, presuming the Hopewellians used pottery before the southern or Marksville type spread to the North, we might expect to find in the northern mounds a type of ware, different from the typical Hopewell vessels, that had been used before the intrusion of a southern type. Up to the present time there is no such evidence, so far as the writer is aware. Future investigations may prove that the Hopewell culture in the North is an amalgamation of certain characteristics—mound building, pottery, barracuda jaws, tortoise shells—derived both by trade and contact from the South and a definite group of characteristics—realistically carved stone pipes, copper, and obsidian—which originated with and were developed by the Hopewell people themselves.

Although there is not so much evidence of trade from North to South as *vice versa*, these vessels, nevertheless, might have been traded into the South. Yet this would hardly account for the variations from typical Hopewell decorations at Marksville, which

have never been reported from the North. Even though the direction of spread is not entirely clear, there seems to be an adequate basis for some correlation based on pottery alone. The study made later in this paper would seem to show that in comparison with other ceramic ornamentation in the Southeast the Hopewell style of decoration is not so outstanding nor so highly developed as it is when contrasted with the pottery from other cultures in the upper Mississippi Valley.

If the pottery from Mounds 4 and 8 in the Marksville works is sufficiently similar to be considered related to the northern Hopewell type, we should compare other artifacts as well as the construction of Mounds 4 and 8 with typical Ohio Hopewell sites.

Turning to Mr. Fowke's report, we gain a picture of the Marksville site, together with the burial customs practiced by the builders of Mound 4.⁶

The most striking resemblances are the use of bark-lined graves and the circular earthworks. The typical form of burial in the Ohio Hopewell mounds, however, consisted of placing the bodies on well-prepared earth platforms and surrounding the rectangular graves with parallel logs two or three tiers high. One might interpret the platform of clay found in Mound 4 as analogous to the well-prepared burial platforms among the Ohio Hopewell. The intrusive burials, described by Fowke, seem out of place among the more general Hopewell characteristics.

From Fowke's description of Mound 8,⁷ we find such characteristics as bark-lined graves and possibly cremated human burials, which are also found in the Ohio Hopewell mounds. Graves dug beneath the original level of the mound, however, while not typical in Ohio except in the Adena culture,⁸ have been found in mounds belonging to the Wisconsin⁹ and Illinois variants of the Ohio Hopewell.

Mounds 4 and 8 lacked artifacts made from obsidian, mica, and copper so common in the northern mounds. Then, too, other features, such as tortoise shells, pearls, conch shells, ear spools, head ornaments, ceremonial skulls, crematory basins, colored and plain textiles, carved animal bones, and effigy pipes, which are not found in all the Hopewell mounds but in the majority of them, were not found at Marksville.¹⁰

⁶ Fowke, G., 44th Ann. Rep. Bur. Amer. Ethnol., pp. 411-422, 1928.

⁷ *Ibid.*, pp. 423-424.

⁸ Greenman, E. F., Excavation of the Coon mound and an analysis of the Adena culture. *Ohio Arch. and Hist. Quart.*, vol. 41, no. 3, pp. 411-502, 1932.

⁹ McKern, W. C., Wisconsin variant of the Hopewell culture. *Bull. Public Mus. City of Milwaukee*, vol. 10, no. 2, pp. 185-328, 1931.

¹⁰ For a detailed study of Ohio Hopewell artifacts, see Shetrone, H. C., and Greenman, E. F., Explorations of the Seip group of prehistoric earthworks. *Ohio Arch. and Hist. Quart.*, vol. 40, no. 3, pp. 400-509, 1931.

The few similarities, therefore, in addition to the pottery seem insufficient at the present time to establish Mounds 4 and 8 of the Marksville works as *typical* Hopewell mounds. This fact, however, does not offset the outstanding resemblances between the pottery. It may indicate a variant or basic Hopewell culture in the Southeast with a greater variety of pottery decorations and a diminution of other characteristics.

DETAILED DESCRIPTION OF MARKSVILLE POTTERY

1. FLAT-BOTTOM JAR FROM MOUND 8¹¹

PLATE 1

This is the most perfect vessel with regard to design and workmanship of all the earthenware specimens from the Marksville works. It embodies the most typical characteristics of the so-called Hopewell pottery. (See Table 1.)

The vessel is tempered with either pulverized potsherds or small particles of clay, and breaks in irregular lines. Although the neck and rim are circular, when viewed from above, the body has been shaped into four rounded corners or lobes, which give the impression of a square body. Around the outside of the rim is a $\frac{3}{4}$ -inch band of cross-hatched lines, incised at an angle of 45°. The thin lines were incised first, and the heavier ones, cut from the lower part to the top of the rim, were made afterwards. Beneath this band is an encircling row of indentations made with a round instrument flat on the end, which had been applied to the wall at an oblique angle so that the indentations suggest a bisected cone, the apex of the cone pointing to the left. A polished area separates the rim decoration from that on the rest of the body. Below this is a deeply incised groove.

The body of the vessel is decorated with a beautifully executed design. On the four lobes a conventionalized bird has been outlined. Since only the head of the bird can be used for identification it is difficult to ascertain the species. Dr. Herbert Friedmann, curator of birds, United States National Museum, suggests that the head may represent that of an eagle.¹² Between the two birds facing each other is the outline of a Y; while between the two birds looking away from each other is the outline of a column, expanded on top and flow-

¹¹ My nomenclature regarding these vessels is as follows: Jar—the characteristic form of which is a gradual narrowing of the body and gently recurving to form the neck. Bowl—sometimes globular in shape with no narrowing between body and rim. Vase—straight sides and flat base.

¹² For other examples embodying conventionalized eagle designs, see Mills, W. C., *Exploration of Mound City group. Certain mounds and village sites in Ohio*, vol. 2, pt. 3, pp. 354–359, figs. 60–65, 1922. “Conventionalized” is used here as “a design based on traditional or accepted models.” The drawings, copied from designs on various vessels from Marksville, were made by Richard G. Paine, aid in archeology, U. S. National Museum.

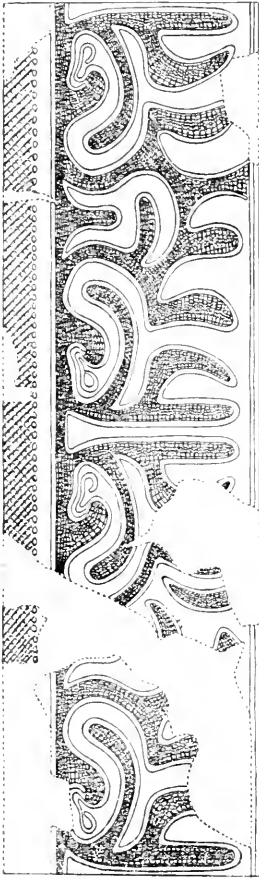


FIGURE 2.—Design from the vessel shown on Plate 1

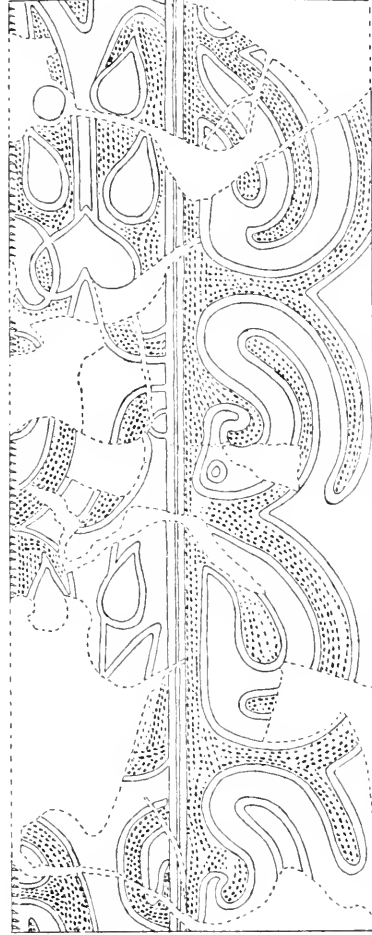
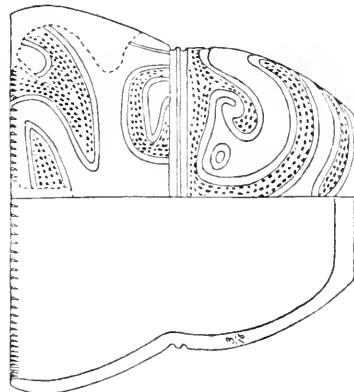
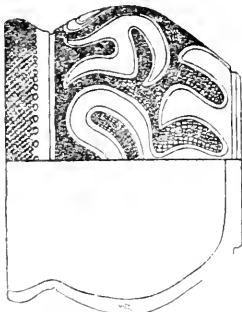


FIGURE 3.—Design from the vessel shown on Plate 2, B



ing into the design near the base (fig. 2). This design is accomplished by a polished band between two deeply incised grooves. The remaining area has been uniformly roughened by means of a roulette and a zigzag technique.¹³ Near the flat base a deeply incised groove incloses the decoration.

This vessel was referred to by Mr. Fowke¹⁴ as follows:

East * * * [of what was assumed to be the center of the mound] was another [grave] a little more than 6 feet long. There was no trace of bone or of anything else in it, except two small pots, one at each end, both of them broken by the pressure of the earth. * * * the other [pot] seems to be globular.

2. FLAT-BOTTOM BOWL FROM MOUND 4

PLATE 2, B

The sides of this inverted cone-shaped vessel are slightly constricted halfway between the base and rim. The tempering material again consists of pulverized potsherds or small particles of clay. Firing has produced a texture that is very uniform and only slightly brittle, breaking in rather straight lines. The surface can be engraved with the finger nail.

The rim is decorated on the outside with triangular notches, apex pointing to the right; on the inside the apex points to the left. Viewed from above, the outside notches point counterclockwise, while the inside notches point clockwise. The constriction of the vessel near the middle divides the decoration into two distinct parts. The motif on the upper half begins close to the rim and extends to the two deeply incised grooves near the middle. The figures, outlined by incised grooves, consist of heart- and pear-shaped objects, and meandering or curvilinear bands, which have been polished, while the rest of the area is uniformly roughened by means of the roulette (fig. 3). The design on the lower half consists of two conventionalized birds, the head of each again suggesting the eagle's. Between the heads seems to be a continuation of the body or wing.

If my interpretation is correct, Fowke¹⁵ refers to this vessel as follows:

* * * at about 20 feet from the beginning and * * * 6 feet up, in the east wall of the trench, were fragments of two pots; one was globular,

¹³ Holmes, W. H., *Aboriginal pottery of the Eastern United States*. 20th Ann. Rep. Bur. Amer. Ethnol., p. 190, fig. 72, 1903.

¹⁴ Fowke, G., 44th Ann. Rep. Bur. Amer. Ethnol., p. 424, 1928. Except in a few instances, it is impossible to determine precisely the specific artifacts Mr. Fowke refers to in the description of his excavation of the mounds. The artifacts described in this paper have been recorded in the United States National Museum files as coming from Mounds 4, 8, 10, and 15 in the Marksville works (fig. 1). In several cases potsherds have been assembled in the Museum to make a fairly complete restoration of the original vessel.

¹⁵ *Ibid.*, pp. 415-416.

with flanging top, of about a pint capacity, decorated with curves and figures impressed with a blunt point.

3. FLAT-BOTTOM BOWL FROM MOUND 8

PLATE 2, A

This bowl is so nearly identical in form and decoration with vessel 2 that further description is unnecessary. One is tempted to conclude that they were made by the same potter, so great is the similarity. If this were true, then Mound 8, containing this pot, would likely have been built about the same time as Mound 4, which contained the vessel previously described.

This vessel was found "west of the center [in a circular grave] * * * measuring close to 2 feet in diameter. * * * a pot ornately decorated; * * * broken into many pieces."¹⁶

4. FLAT-BOTTOM BOWL FROM MOUND 4

PLATE 2, C

This bowl contains the same tempering material as the other vessels. The texture is soft, breaking in straight lines.

Between two parallel encircling grooves 1 inch apart is a decorated band consisting alternately of a series of three parallel grooves 1 inch long and a series of nine indentations, three rows of three each, made with a blunt instrument. The design, somewhat resembling the base of a projectile point, is repeated three times around the vessel. It consists of alternating polished and roughened areas outlined by incised grooves. The outlined bands, which have been polished in one of the three areas, are roughened in the adjoining section (fig. 4). The roughening on this vessel is not made with the roulette but by the zigzag technique. So many fragments are missing that one can only guess as to whether the design is geometric or realistic. Mr. Fowke makes no direct reference to this vessel.

5. UNIQUE VESSEL FROM MOUND 4

PLATE 3, A

The tempering of this vessel seems to be pulverized potsherds. The elliptical base has been worn considerably, even though the surface is so hard that it can not be scratched with a finger nail. Only about two-thirds of the sides was found, which in this case was hardly sufficient to determine the complete design. One side and an end show that part of the decoration was executed by outlining smooth polished bands with deeply incised grooves, while the rest of the surface was roughened.

¹⁶ Ibid., p. 424.

6. SMALL BOWL FROM MOUND 4

PLATE 3, B

This vessel is more brittle than most of the lot, which may be due to its having been subjected to heat more intense or of longer duration. It breaks in rather ragged lines.

About an inch from the top of the rim is an encircling line of indentations made with a round tool one-tenth of an inch in diameter, which was forced into the wall at an oblique angle. The apex points to the right. On the more typical Hopewell vessels the space above these indentations would have been filled with a cross-hatched design of fine incised lines. This area, however, is smooth but not polished. Beneath the incised groove encircling the neck, the rest of the body is decorated with small outlined bands, highly polished, and a uniform roughening outside these areas. The roughening in this case has not been accomplished either by means of the roulette or the zigzag technique but rather by means of a small blunt instrument. The polished bands, parallel to one another and vertical to the base, average about $1\frac{5}{16}$ inches long and one-fourth inch wide. Beneath the globular portion of the vessel is a tapering pedestal-like attachment, around which are four parallel deeply incised grooves. The rest of the surface is polished. Not enough fragments were found to reconstruct the base.

7. SMALL FLAT-BOTTOM JAR FROM MOUND 4

PLATE 3, C

Both the interior and exterior surfaces have been polished. The surface can not be cut with a finger nail but only with a sharp-pointed steel instrument. An encircling band, three-eighths of an inch wide, below the rim has been decorated with lightly incised parallel lines at a 45° angle. The usual 45° lines running in the opposite direction completing the cross-hatched design are missing. Around the neck of the vessel is a decoration consisting of two deeply incised parallel grooves about $1\frac{5}{8}$ inches long, which terminate in a group of six circular indentations in two rows of three each. Covering the entire body are various patterns made by parallel incised grooves so close to one another as to give the effect of corrugated concentric triangles and diamond shapes. The narrow bands between the grooves have been highly polished. Two parallel encircling grooves separate the decoration from the plain flat bottom.

Mr. Fowke may have had the sherds of this vessel in mind when he wrote: "The other, of which there was only a part, was differently decorated."¹⁷

¹⁷ *Ibid.*, p. 416.

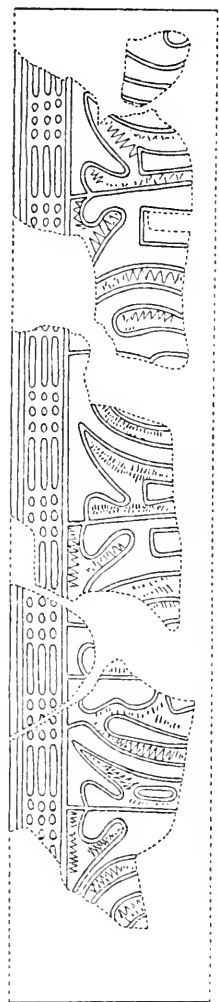


FIGURE 4.—Design from the bowl shown on Plate 2, C

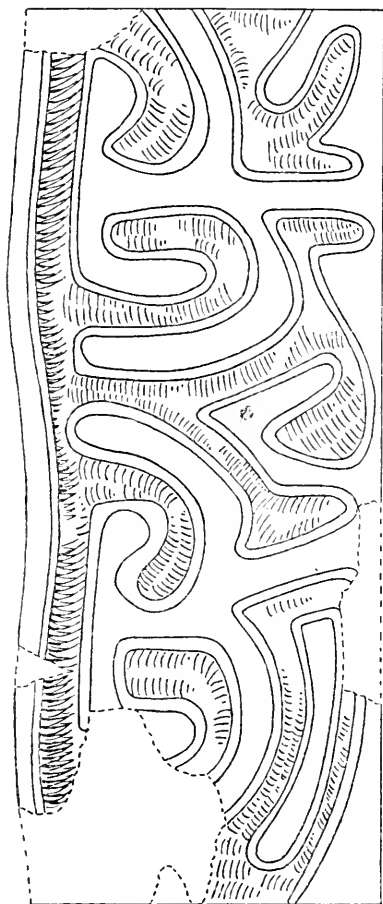
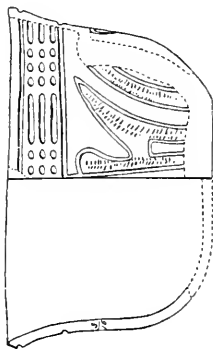
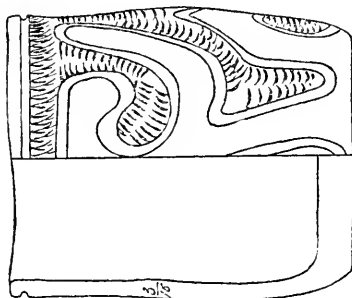


FIGURE 5.—Design from the vase shown on Plate 4, C



8. MINIATURE FLAT-BOTTOM JAR FROM MOUND 4

PLATE 3, D

The tempering of this jar is impossible to determine. The surface is rather hard and can be scratched only with a sharp steel point. Such a small portion of the rim remains intact that it gives no clue to its decoration. Below two incised parallel encircling grooves, the elements on the globular body are divided into two parts. The main feature on each half consists of two highly conventionalized birds—probably representing eagles—facing each other. The bodies or wings are outlined on the base of the vessel. This is the only vessel from Marksville that has the decoration extending around the base. The outlines have been formed by deeply incised grooves so close together that only a very narrow ridge remains between them, which has been highly polished.

9. MINIATURE VASE FROM MOUND 4

PLATE 4, A

The inside surface is rough and has the appearance of small particles of sand protruding; nevertheless these lumps are small pieces of clay consisting either of soft pulverized potsherds or of clay pellets not completely assimilated in the original mixing. The outside surface can be scratched with the finger nail. The rim, which is quite uneven, is decorated only on the outside with longitudinal indentations vertical to the wall of the vessel. Below the indentations is an encircling groove with five small circular indentations on one side of the vessel, none penetrating the wall. The rest of the decoration consists of meandering incised lines, about one-sixteenth of an inch wide, around the body. In certain areas between the grooves there is evidence of a roulette roughening, which was not entirely effaced when the vessel was polished.

Because this vessel was illustrated in Mr. Fowke's preliminary report¹⁸ it can be definitely identified as the one "20 inches above the bottom— * * * Among the remains was one decorated pot 2 inches high containing minute desiccated fragments of corn, squash, and perhaps other forms of food. A leaf, apparently a corn blade, had been placed over the top."¹⁹

¹⁸ Fowke, G., *Smithsonian Misc. Coll.*, vol. 78, no. 7, p. 259, 1927.

¹⁹ Fowke, G., 44th Ann. Rep. Bur. Amer. Ethnol., pp. 420-421, 1928.

10. FLAT-BOTTOM VASE FROM MOUND 4

PLATE 4, B

Tempering of this vase may be pulverized potsherds or hard particles of clay. The surface can be cut only with a sharp-pointed steel instrument; a finger nail makes no impression. The rim has been notched and three-eighths of an inch below it are two encircling shallow grooves. An area between these grooves and those near the base has been decorated with meandering shallow grooves. No roughening appears between them. The outside surface has been highly polished.

11. VASE FROM MOUND 8

PLATE 4, C

The tempering used in this vessel is either potsherds or clay, making the fired pot quite soft and breakable in straight lines.

The decoration somewhat resembles a **T** with two ascending curved bands beginning near the middle of the vertical bar and terminating near the rim (fig. 5). Here again the main element is outlined by deeply incised grooves with certain areas between the grooves polished and the rest of the vessel roughened with zigzag lines. This method of roughening is best described by Mr. Willoughby²⁰:

* * * and filled with zigzag patterns which were not made with a roulette, * * * but with a tool more or less gouge-shaped, having a plain or notched edge, which was pressed against the soft clay with a rocking motion, each opposite corner being raised and slightly advanced alternately, the tool not being wholly lifted from the vessel.

Both polished and roughened bands average about five-eighths of an inch wide.

Fowke²¹ refers to this vase as follows: "East of this grave was another a little more than 6 feet long. * * * two small pots, one at each end, * * * One was shaped like a common flowerpot and contained one valve of a mussel shell; * * *"

12. VASE FROM MOUND 4

PLATE 4, D

Besides the restored vessels, there is one small vase from Mound 4 partly restored. The tempering consists of either pulverized potsherds or small particles of clay. The surface is so soft that it can easily be scratched with the finger nail. It is decorated with deeply incised concentric grooves and intervening narrow bands.

²⁰ Willoughby, C. C., Turner group of earthworks, Hamilton County, Ohio. Papers Peabody Mus. Amer. Arch. and Ethnol., Harvard Univ., vol. 8, no. 3, p. 92, pl. 23, 1922.

²¹ Fowke, G., 44th Ann. Rep. Bur. Amer. Ethnol., p. 424, 1928.

13. MINIATURE VASE FROM MOUND 4

PLATE 4, E

The outside surface exhibits a certain roughness due to particles of either potsherd-tempering or unpulverized clay. It can be scratched with a finger nail. Except for minutely incised lines or scratches running in all directions, there is no decoration. The interior surface shows numerous shallow cracks, perhaps due to expansion and contraction when fired. On opposite sides of the vessel near the rim are two small holes through which a thong or cord may have been passed to suspend it.

The two small holes make possible our identification of this vessel from Fowke's report²²: "In the east wall of the trench, 10 feet out, 2 feet up, was an infant burial; with it was a 'flowerpot' vase less than 2 inches high, with two small holes near the top for suspension; * * *"

14. BOWLS FROM MOUND 4

PLATE 4, F-H

Three partially restored bowls from Mound 4 are made of rather flaky clay, the tempering being either pulverized potsherds or hard particles of clay. The inside and outside surfaces of the three specimens can be scratched with the finger nail. Since the vessels are not decorated they are very likely utilitarian or culinary bowls.

The variety of rim sherds from Mounds 4 and 8 is great. Enough of the decoration below the rim is present to indicate the similarity in decoration to that of the restored vessels illustrated.

Associated with the pottery from Mounds 4 and 8, Mr. Fowke found the following artifacts: Monitor or platform pipe of clay from Mound 4 (pl. 5, A); the fragmentary base of another platform pipe from the same mound (pl. 5, B); three projectile points (pl. 5, C.); sandstone rubbing or smoothing stones (pl. 5, D); impressions in clay of a vertically plaited matting consisting of over-two-under-two technique from Mound 8²³ (pl. 5, E).

The few artifacts from Mound 10 (pl. 6, A-C) show no resemblance either to the material from Mounds 4, 8, and 15, or to the general Hopewell culture. Mr. Fowke²⁴ describes the excavation of these artifacts as follows:

The usual pieces of pottery, charcoal and flint were found. There were also two small pieces of grooved burned clay similar to those occurring so abundantly north of Delhi; a small much used hammer or flint chipper of yellowish quartz, and a symmetrical, highly polished plummet made of magnetic iron ore.

²² Ibid., p. 420.

²³ For similar matting from an Ohio Hopewell mound, see Mills, W. C., *Exploration of Mound City group. Certain mounds and village sites in Ohio*, vol. 3, pt. 4, p. 382, fig. 81, 1922.

²⁴ Fowke, G., 44th Ann. Rep. Bur. Amer. Ethnol., pp. 425, 1928.

The two unidentified baked clay objects (pl. 6, B) are similar to specimens in the United States National Museum found by C. B. Moore in a kitchen midden at Poverty Point, West Carroll Parish, north-eastern Louisiana. Associated with a burial on the Schwing Place (fig. 6), Iberville Parish, in the south-central part of the State, was a cache of 32 clay objects.²⁵

Mound 15, on the same side of the river as Mounds 4 and 8 and only a short distance from Mound 8 (fig. 1), seems to have been constructed by an entirely different group of Indians possessing a culture radically different from the builders of Mounds 4 and 8. Fowke²⁶ says:

* * * broken pottery with various designs incised or impressed, were profusely scattered loose in the earth. One small potsherd [pl. 6, F] had a decoration in red resembling those of Arkansas. Diligent search was made for other pieces like it, but none could be found. It was almost useless to hunt for anything in the mud.

The sherds (pl. 6, D, E, F) resemble the ware found throughout the Southeast, except D and E, which occur only along the Gulf coast. All of them, however, are unrelated in decoration and tempering to the pottery found in Mounds 4, 8, and 10 or in the upper Mississippi region.

HOPEWELL POTTERY FROM OTHER SOUTHEASTERN SITES

To enlarge upon the possibility that a basic Hopewell culture might have originated in the South and a branch spread or migrated and later developed in the upper Mississippi Valley, it seems imperative that the vessels from Mounds 4 and 8 be compared with pottery from the same region (fig. 6). C. B. Moore obtained pottery from mounds in Mississippi, Louisiana, and Arkansas, which is pertinent. M. R. Harrington found pottery in Arkansas, which is also comparable. Here again I have had to depend entirely on illustrations and descriptions for my examples.

From Anderson Landing, on the Sunflower River, Sharkey County, Miss., Moore²⁷ obtained two vessels that show definite Hopewell characteristics in their decoration. One flat-bottom jar has four lobes. Just below the rim is a cross-hatched band with an encircling line of indentations. The decoration over the body of the vessel consists of narrow, smooth bands outlined by deeply incised grooves and the rest of the surface uniformly roughened by means of a roulette.

²⁵ Moore, C. B., Some aboriginal sites in Louisiana and in Arkansas. *Journ. Acad. Nat. Sci. Philadelphia*, vol. 16, pp. 15; 72, pl. 2; 73-74, 1913.

²⁶ Fowke, G., 44th Ann. Rep. Bur. Amer. Ethnol., p. 430, 1928.

²⁷ Moore, C. B., Certain mounds of Arkansas and Mississippi. *Journ. Acad. Nat. Sci. Philadelphia*, vol. 13, pt. 2, pp. 586-588, figs. 3-5, 1908.

A vessel similar in its general manner of design but different in regard to the method used in roughening was found by Harrington²⁸ at the Washington site, Hempstead County, southwestern Arkansas.

Moore's second vessel, from Anderson Landing, has incised cross-hatching and cone-shaped punctations encircling the vessel just below the rim. Repeated three times around the body is the conventionalized design of a bird, the head resembling that of an eagle. This design is made by a smooth band outlined by two incised grooves. No evidence of roughening appears, but the bird somewhat

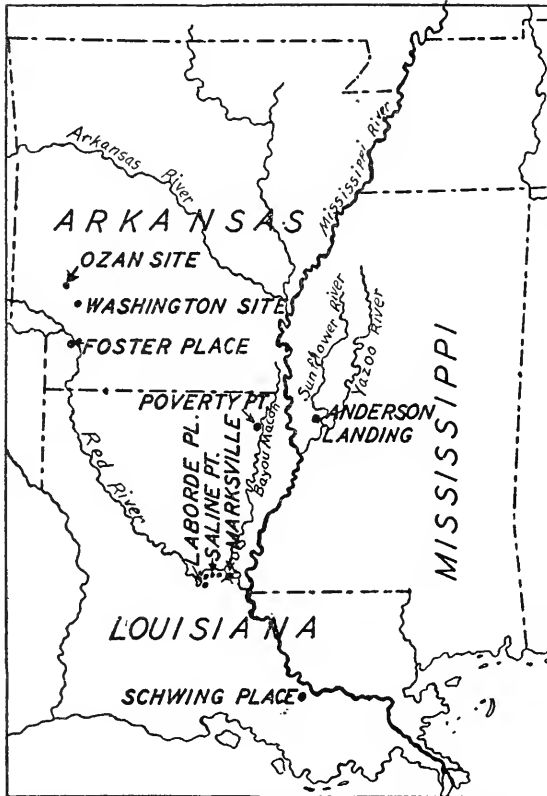


FIGURE 6.—Sites from which pottery is compared with that found at Marksville, La.

resembles the figures on four of the Marksville vessels (pls. 1; 2, A, B; 3, D). As to the tempering, Moore²⁹ states simply that neither of the above two vessels is shell tempered.

From the upper mound on Saline Point (fig. 6), Avoyelles Parish, La.—a few miles northeast of the Marksville works—on Red River, Moore found evidence of cremated bones and numerous potsherds and vessels.³⁰ With the exception of the jar, which he illustrates in Figure 6, page 499, one would hardly consider them of the Hopewell type. However, since all came from

the same mound, which had no apparent stratification, they might possibly be regarded as variations from the true Hopewell forms.

The design on the vessel shown by Moore as Figure 6, page 499, contains two distinct Hopewell traits, namely, cross-hatched incised

²⁸ Harrington, M. R., Certain Caddo sites in Arkansas. *Indian Notes and Monog. Mus. Amer. Indian*, Heye Foundation, New York, p. 144, pl. 51, b. 1920.

²⁹ Moore, C. B., *Journ. Acad. Nat. Sci. Philadelphia*, vol. 13, pt. 2, p. 586, 1908.

³⁰ Moore, C. B., *Aboriginal sites on Red River. Journ. Acad. Nat. Sci. Philadelphia*, vol. 14, pp. 498-500, 1912.

lines just below the rim and the conventionalized birds. The two parallel grooves and six indentations repeated around the neck are similar to two vessels from Marksville (pls. 2, C; 3, C).

A hemispherical bowl, with an unusual design,³¹ was found in the same mound. The surface is divided into two parts by a wide smooth band outlined by two incised grooves. The design is repeated twice on the vessel. It consists of straight and angular bands containing punctations outlined by incised grooves. Such roughening is unusual on the Hopewell vessels and on those from Marksville, but may be a clue to either the relation or spread of this technique in other southeastern pottery vessels.

Associated with a skeleton, in an excavated pit of a cemetery on the Johnson Place,³² Avoyelles Parish, La., was a flat-bottom vessel. Its straight sides are covered with deeply incised grooves so closely spaced that only a very narrow smooth band remains between them. The decoration consisting of narrow smooth bands is similar to that on two jars and the fragment of a vase from Marksville (pls. 3, C, D; 4, D).

In a mound located on the Mayer Place, 1 mile southwest of the Johnson Place, a vessel was found³³ that had been decorated with conventionalized birds having eagle heads. The figures are again outlined by deeply incised grooves. This is the fifth vessel from Avoyelles Parish upon which conventionalized birds have been used for decoration.

Burial No. 8, in the Laborde Place mound,³⁴ contained four vessels and several potsherds. One small hemispherical bowl resembles in decoration the aforementioned vessels only in the outlining of curved bands by deeply incised grooves. Below the two parallel encircling grooves near the rim is a design somewhat like the S-shaped line forming one-half of a swastika. The unusual feature of this decoration is that instead of roughening the area either inside or outside the grooves, for the desired contrast, the bands between the grooves had been painted with a red pigment. The inside of the bowl contained a fairly good coating of red pigment. This might be carrying the similarity too far, since no applied pigment has ever been reported on Hopewell pottery from the North. Yet the scroll design formed by the outlined bands shows some relationship to the swastika design on the vessel from Saline Point, and the vessels from Saline Point did embody true Hopewell characteristics.

Leaving the parish in which Marksville is located and considering the Foster Place³⁵ along Red River, in Lafayette County, Ark.,

³¹ *Ibid.*, p. 500.

³² *Ibid.*, p. 502.

³³ *Ibid.*, p. 503.

³⁴ *Ibid.*, p. 506.

³⁵ *Ibid.*, pp. 591-619.

Moore illustrates a large variety of painted and incised vessels. The majority seem to have no relationship to the Hopewell pottery, but a few show very general characteristics, which might have some connection with the pottery from Avoyelles Parish, La. Here again the most outstanding characteristic is the roughened or smooth bands of decorations outlined by deeply incised grooves.

A flat-bottom jar with a decoration around the body consists of alternating rough and smooth bands, which may represent some part of the swastika. The method of roughening in this case is radically different from any of the aforementioned vessels. It has been accomplished, seemingly, with a sharpened instrument the exact width of the band, and applied at right angles to the grooves. A jar very similar to this one was found by Harrington³⁶ at Site 1, Ozan, Ark.

Another jar from the Foster Place has been decorated by alternating, smooth, punctated, concentric, circular bands, outlined by incised grooves. This punctate roughening technique is similar to the bands on the vessel from Saline Point, Avoyelles Parish, La.

An unusual form from this mound on the Foster Place has a globular body with a very high straight-sided neck and a small out-flaring rim. The decorations encircling the neck and body are similar. A wide smooth band outlined by incised grooves forms the S-shaped figure of the swastika, while the rest of the surface has been uniformly roughened with shallow indentations in no particular order.

In the same mound were numerous other types of vessels—some painted and incised, others engraved and painted—which seem to show no relationship in their manner of decoration to those vessels from Avoyelles Parish, La., or the Hopewell types, but which show a definite relationship to pottery that has been called Caddo³⁷ from this region. Since Moore speaks of no apparent stratification in the mound, one may assume that vessels showing resemblances in their decoration to those from Avoyelles Parish might have been found associated with the more typical Caddo ware. Further research may develop this relationship. The vessels herein described from the Foster Place show no direct resemblances with the Hopewell pottery from the upper Mississippi Valley, but are comparable with specimens from Avoyelles Parish, La., while the Avoyelles Parish pottery, especially in the case of Marksville, does resemble typical Hopewell pottery.

Further investigations should throw more light on this interesting distribution. It would seem, however, from the foregoing facts

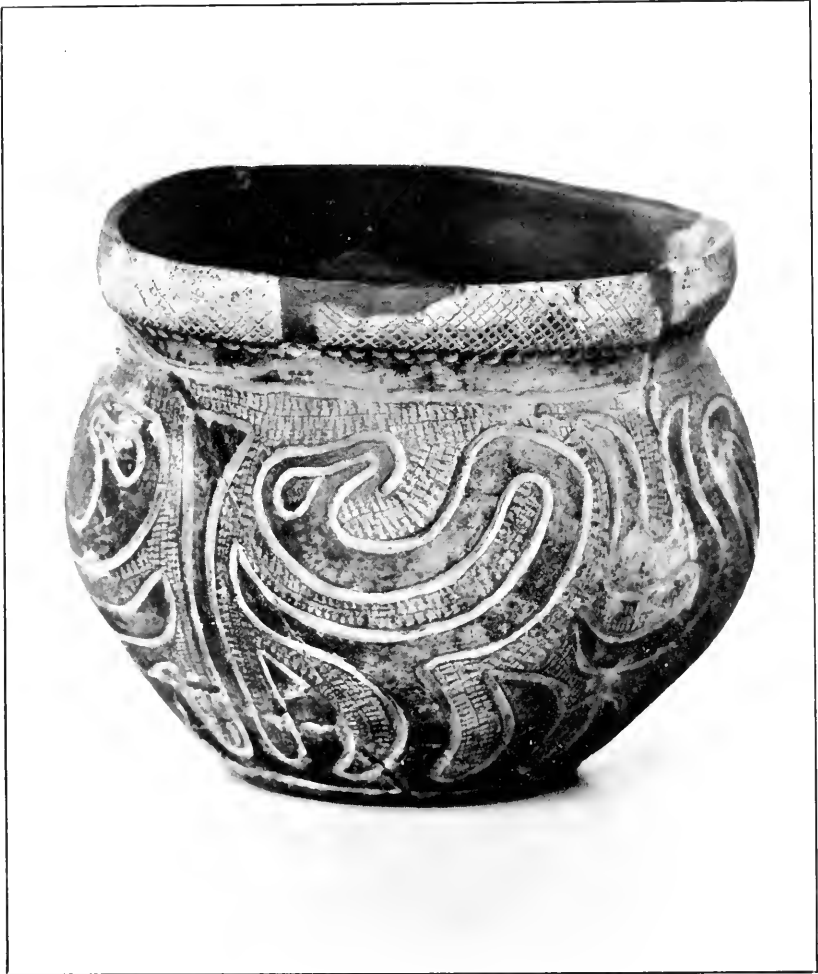
³⁶ Harrington, M. R., *Indian Notes and Monog. Mus. Amer. Indian*, Heye Foundation, New York, p. 144, pl. 51, a, 1920.

³⁷ For a detailed study of so-called Caddoan archeological sites, see Harrington, M. R., *op. cit.* These sites also seem to indicate a relationship to some of the other more general Hopewell characteristics besides pottery.

that Louisiana, Mississippi, and possibly Arkansas must be considered in the distribution of Hopewell-like traits. These similarities might be due entirely to commercial intercourse, but they seem too widespread for such a simple explanation.

A brief recapitulation shows that the Marksville works contained one vessel (pl. 1) that can be considered a typical Hopewell vessel. In addition, the other vessels from Mounds 4 and 8 embody one or more typical Hopewell characteristics. More than this, the variety of forms at Marksville not only shows designs characteristic of the typical Hopewell in the North, but these same vessels have certain features that are similar to other southeastern pottery decorations. These latter similarities make possible a comparison between certain pottery decorations from sites in which typical so-called Caddo pottery has been found associated with the Avoyelles Parish type of vessels.

At the present time no evidence has been found in Ohio, Indiana, Illinois, Iowa, Michigan, or Wisconsin that will enable anthropologists to determine either the ethnological or linguistic connections between this highly developed archeological culture and the recognized Indian stocks. It would seem from the Marksville evidence that further scientific investigations in this portion of the Southeast should produce definite evidence regarding the origin, development, and migration of this interesting archeological culture.



TYPICAL HOPEWELL VESSEL FROM THE MARKSVILLE WORKS
From Mound 8. Diameter, 3¼ inches; height, 4¾ inches. U.S.N.M. No. 331688.



BOWLS FROM MOUNDS 4 AND 8, MARKSVILLE WORKS

- A*, From Mound 8. Diameter, $5\frac{1}{8}$ inches; height, $4\frac{13}{16}$ inches. U.S.N.M. No. 331689.
B, From Mound 4. Diameter, $5\frac{3}{8}$ inches; height, $4\frac{1}{32}$ inches. U.S.N.M. No. 331697.
C, From Mound 1. Diameter, $6\frac{23}{32}$ inches; height, 4 inches. U.S.N.M. 331696.



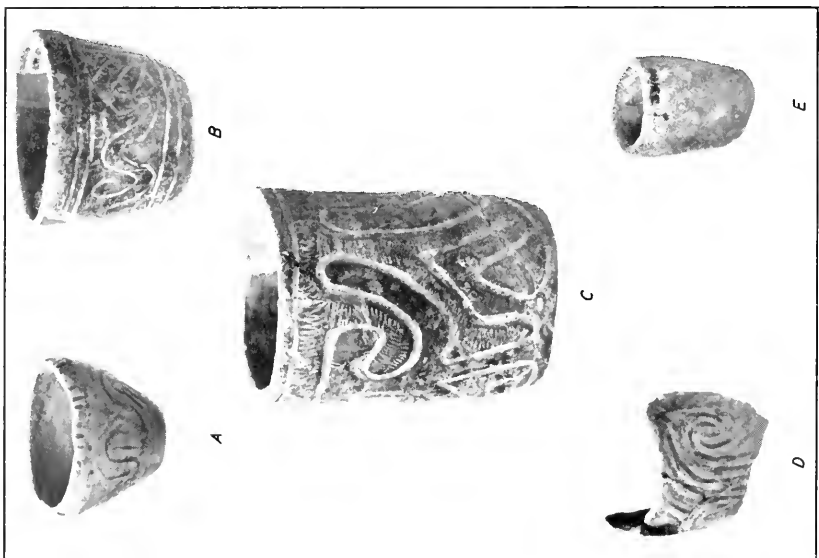
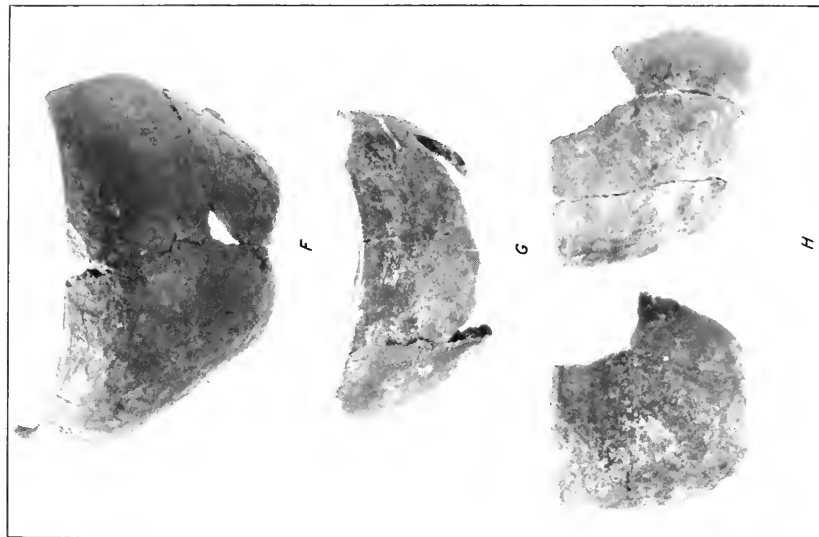
VESSELS FROM MOUND 4, MARKSVILLE WORKS

A, Unique form. U.S.N.M. No. 331694

B, Hourglass form. U.S.N.M. No. 331700.

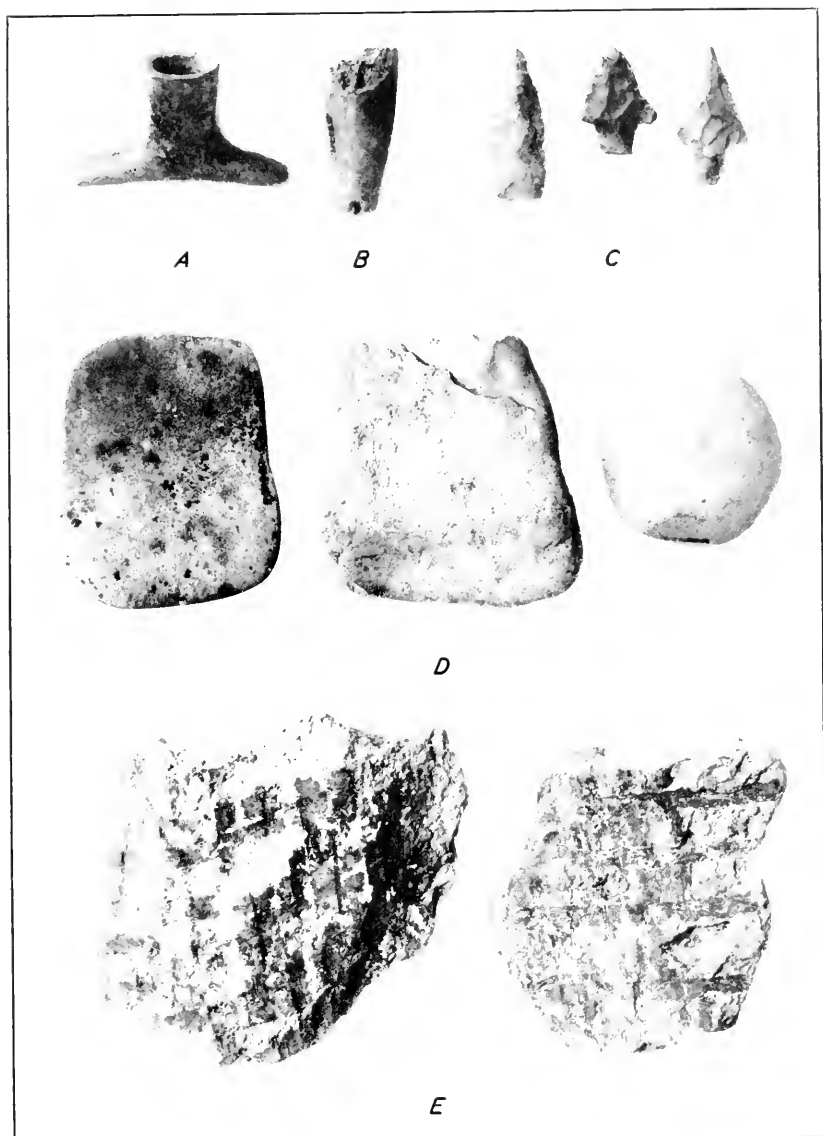
C, Diameter, $4\frac{1}{8}$ inches; height, $3\frac{11}{16}$ inches. U.S.N.M. No. 331697A.

D, Diameter, $2\frac{1}{4}$ inches; height, $1\frac{1}{16}$ inches. U.S.N.M. No. 331709.



POTTERY VASES AND UNDECORATED FRAGMENTS FROM MOUNDS 4 AND 8, MARKSVILLE WORKS
E, Diameter, 2½ inches; height, 1½ inches. U.S.N.M. No. 331692.
F, Diameter, 3 inches; height, 2½ inches. U.S.N.M. No. 331708.
G, Diameter, 3½ inches; height, 4½ inches. U.S.N.M. No. 331686.
H, U.S.N.M. No. 331705A.
I, U.S.N.M. No. 331705B.
 All from Mound 4 except *C*, which is from Mound 8.

A, Diameter, 2½ inches; height, 1½ inches. U.S.N.M. No. 331692.
B, Diameter, 3 inches; height, 2½ inches. U.S.N.M. No. 331708.
C, Diameter, 3½ inches; height, 4½ inches. U.S.N.M. No. 331686.
D, U.S.N.M. No. 331705A.
E, U.S.N.M. No. 331705B.



ARTIFACTS FROM MOUNDS 4 AND 8, MARKSVILLE WORKS

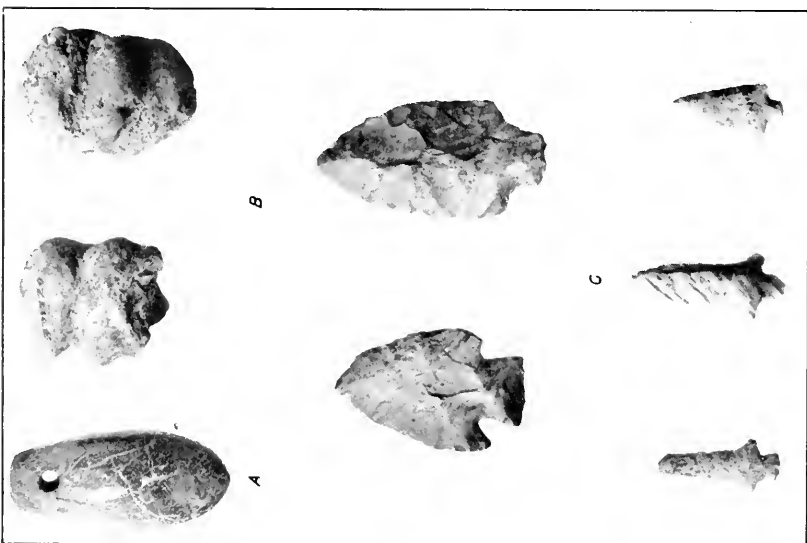
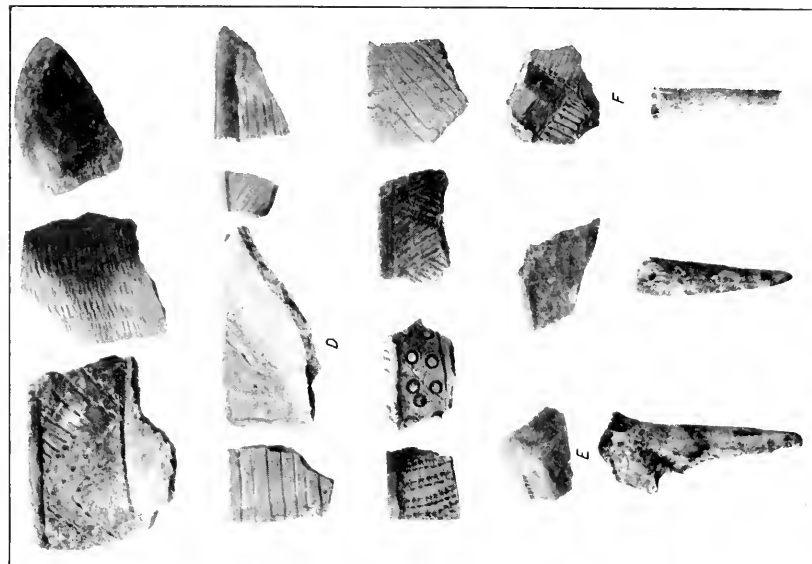
A. Clay platform pipe. U.S.N.M. No. 331691.

B. Fragment of clay platform pipestem. U.S.N.M. No. 331711.

C. Projectile points. U.S.N.M. No. 331703.

D. Sandstone rubbing stones. U.S.N.M. No. 331702.

E. Impressions of plaited matting in clay. Mound 8. U.S.N.M. No. 331687.



ARTIFACTS FROM MOUNDS 10 AND 15, MARKSVILLE WORKS

A, Magnetic iron-ore plummet. U. S. N. M. No. 331722.
 B, Undentified baked-clay object. U. S. N. M. No. 331720.
 C, Projectile points. U. S. N. M. No. 331719.

D, E, Type of sherds that usually occur along the Gulf coast. U. S. N. M. Nos. 331712-17 (D-F).
 F, Sherd with red pigment between incised lines.

A-C from Mound 10; D-F from Mound 15.

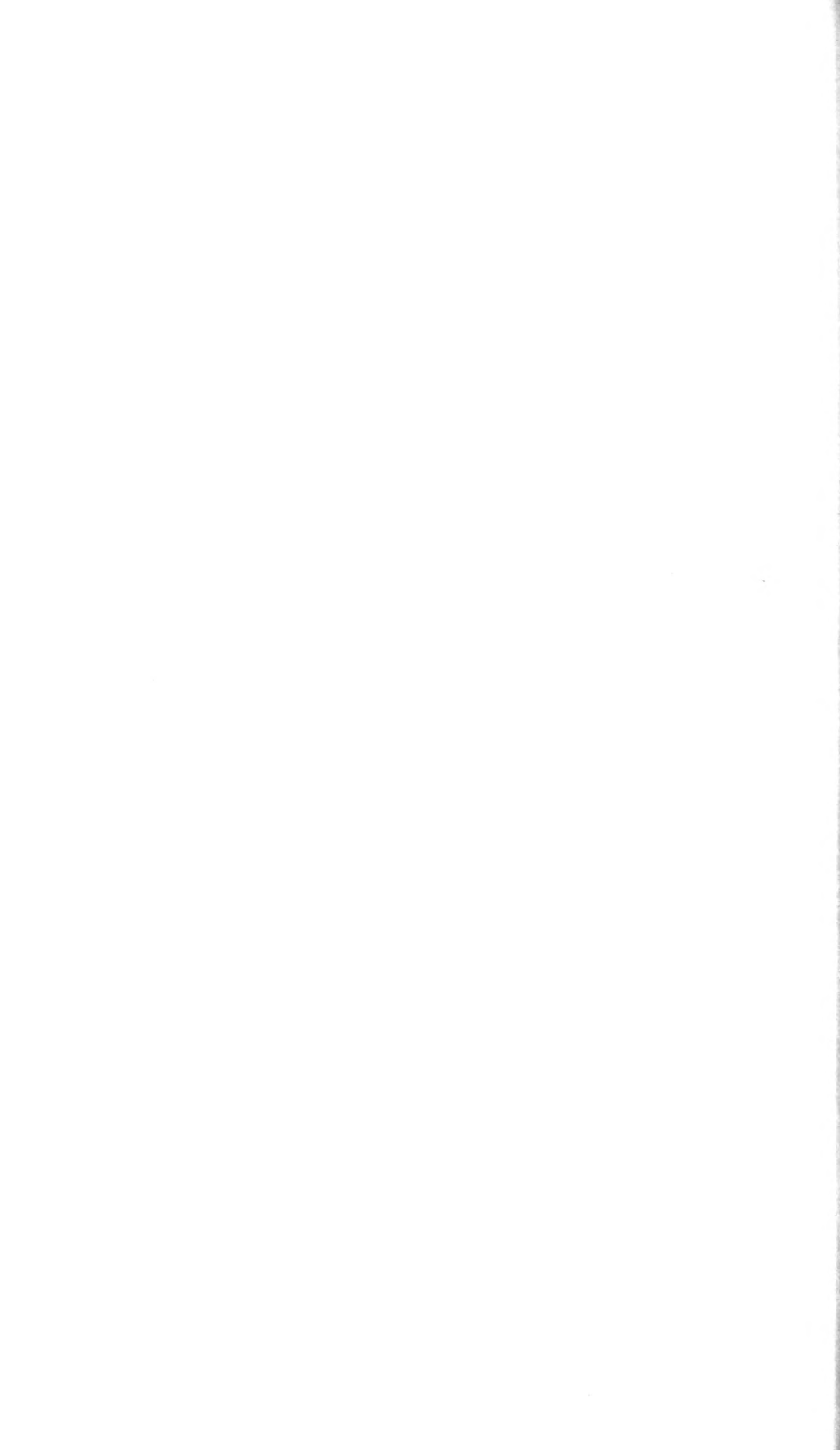


HOPWELL VESSELS FROM MOUND CITY GROUP, OHIO
FOR EXPLANATION OF PLATE SEE NEXT PAGE.

EXPLANATION OF PLATE 7

A copy of page 49 of "Sketches of Monuments and Antiques; Found in the Mounds, Tombs and Ancient Cities of America," a portfolio of drawings made by James Plunket in 1856 for Dr. E. H. Davis showing the archeological specimens in his collection. The portfolio is in the manuscript room of the Bureau of American Ethnology, Smithsonian Institution.

- A, Hopewell vessel from the Mound City group, a few miles north of Chillicothe, Ohio. Illustrated in "Ancient Monuments of the Mississippi Valley" (Smithsonian Contributions to Knowledge, vol. 1, pl. 46, fig. 2, 1848), and again by W. C. Mills in "Certain Mounds and Village Sites in Ohio" (vol. 3, pt. 4, p. 332, fig. 39, 1922).
- B, Hopewell vessel from Mound 1, 2, or 3 in the Mound City group of Ohio. Perhaps never before illustrated.
- C, Hopewell vessel from the Mound City group illustrated in "Ancient Monuments of the Mississippi Valley" (op. cit., pl. 46, fig. 1).
- D, Hopewell vessel probably from the Mound City group. Never before illustrated.



A NEW PROTOZOAN FROM THE LARVA OF THE BEETLE OSMODERMA SCABRA

By CLARKE COURSON ZELIFF

Washingtonville, Pa.

Smears from the hind intestine of the larva of *Osmoderma scabra*, a large black beetle that inhabits decaying sawdust and wood, contain abundant *Nyctotherus* Leidy. An investigation of the literature reveals that more than 25 species of this ciliate genus have been described from about the same number of hosts. Description of the new species is given below.

The drawings herein were made with the camera lucida at $\times 1,600$ and $\times 700$.

NYCTOTHERUS OSMODERMAE, new species

Specific diagnosis.—Body of organism typically egg shaped. Size 50μ to 87μ long and 44μ to 68μ wide. A large group are 66μ to 70μ long and 50μ to 60μ wide. Nuclei oblong or convex and 24.6μ long and 11.2μ or 8μ wide. The cytopharynx ends at 20.8μ from the posterior end and in the average-size specimen about 32μ and 16μ , respectively, from the oral and aboral sides or surfaces. Cytopharynx 48μ long. Cilia 8μ long and the rows 3.2μ from each other. Micronucleus (pl. 1, fig. 2) anterior to the macronucleus and frequently slightly imbedded in it; the shape is oblong and the size 3.2μ long by 2.4μ wide. The chromatin is distributed in small nearly spherical masses. A caryophore, or suspensor of the nucleus, is visible in many specimens. Cytoplasm in the anterior end differentiated from that posterior to the nucleus by lack of vacuoles. A distinct cytopynge (pl. 1, fig. 2) is located at the extreme posterior end.

Dividing forms.—Stages of division of *Nyctotherus* have been observed in detail by Zulueta (1916) in *N. ovalis*. The forms examined by me (pl. 2) are much like those described and pictured by him, with the exception of (pl. 2, fig. 2) an individual with two new cytopharynges formed previous to the division of the nucleus. As stated by Zulueta, the organelles disappear before division, to be formed anew in the daughter cells (pl. 2, fig. 1). It is not possible to follow the activities of the micronucleus in the material available, but it has been clearly seen in one organism (pl. 2, fig. 5) in the late phase of

cell division and also in two organisms with the macronuclei much elongated, as in the stage shown in plate 2, figure 2. In the latter the micronucleus was longer than usual, but no delicate spindle was detected. The chromatin is in spherical granules. One dividing organism similar to that shown in plate 2, figure 3, is almost separated into daughter cells, and yet the isthmus connecting the daughter macronuclei still remains.

Type specimen.—U.S.N.M. no. 8586.

Host.—*Osmoderma scabra*.

Location.—Posterior intestine.

Distribution.—Pennsylvania.

Remarks.—The distinctive features about the species are the size and shape of the nuclei and other organelles. The absence of the caryophore in some specimens may be due to the preparation, or it may suggest that it is an artifact. Grassé (1926) divides the genus *Nyctotherus* into two groups, depending upon the presence or absence of the caryophore. For those lacking this organelle he suggests the new genus name *Nyctotherides*.

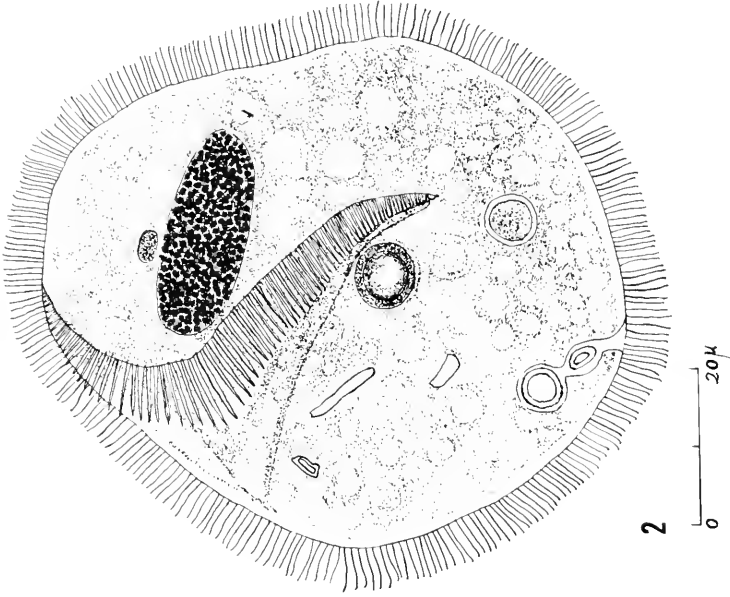
TABLE 1.—Recorded species of *Nyctotherus*

SPECIES	HOST	LOCATION
<i>africanus</i> Castellani	<i>Homo sapiens</i>	Intestine (C).
<i>amaniensis</i> Bezenberger	<i>Bufo</i> sp.	Intestine.
<i>buissoni</i> Pinto	Cockroach	Intestine (C).
<i>comatulae</i> Claparède and Lachmann.	<i>Comatula mediterranea</i>	Intestine and coelomic fluid.
<i>cordiformis</i> Ehrenberg	<i>Rana temporaria</i> , <i>R. esculenta</i> , <i>Bombinator igneus</i> , <i>Bufo cinereus</i> , <i>B. melanostictus</i> .	Intestine and cloaca (C).
<i>cunhai</i> Pinto	<i>Hyla crosepedospila</i>	Intestine.
<i>duboisii</i> Künstler	<i>Cetonia aurata</i> (larvae), <i>Oryctes nasicornis</i>	Intestine (C).
<i>faba</i> Schaudinn	<i>Homo sapiens</i>	Intestine.
<i>giganteus</i> Krause	do.	Do.
<i>györyanus</i> Claparède and Lachmann.	<i>Hydrophilus piceus</i>	Do.
<i>haematobius</i> Claparède and Lachmann.	<i>Apus canceriformis</i> , <i>Lepidurus productus</i>	Branchial sacs.
<i>haranti</i> Grassé	<i>Tarentola mauritanica</i>	Intestine (C).
<i>kempi</i> Ghosh	<i>Ampullaria globosa</i>	Rectum.
<i>macropharyngeus</i> Bezenberger	<i>Rana tigrina</i> , <i>R. cyanophlyctis</i> , <i>R. hexadactyla</i>	Cloaca.
<i>magnus</i> Bezenberger	<i>Rana hexadactyla</i>	Do.
<i>multisporiferus</i> Walker	<i>Cavia cobaya</i>	Intestine.
<i>osmodermae</i> Zetzi	<i>Osmoderma scabra</i>	Mid intestine.
<i>ovalis</i> Leidy	<i>Btatta orientalis</i> , <i>B. germanica</i> , <i>Gryllotalpa vulgaris</i> , <i>Periplaneta americana</i> .	Intestine (C).
<i>papillatus</i> Dobell	<i>Bufo melanostictus</i> , <i>Rana tigrina</i> , <i>Rhacophorus maculatus</i> .	Rectum.
<i>parvus</i> Walker	<i>Rana clamata</i> , <i>R. palustris</i>	Do.
<i>piscicola</i> Dobell	<i>Rana tigrina</i> , <i>Pisarectus brachypomus</i>	Intestine (C).
<i>reniformis</i> Bhatia and Gulati	<i>Bufo macrotis</i>	Rectum.
<i>termitis</i> Dobell	<i>Calotermes miharris</i>	Intestine (C).
<i>tejerai</i> Pinto	<i>Bufo marinus</i>	Intestine.
<i>tipulae</i> Grassé	<i>Ctenophora elegans</i>	Do.
<i>travassosi</i> Cunha and Pinto	<i>Glossoscolex wiengreeni</i>	Do.
<i>reloz</i> Leidy	<i>Julus marginatus</i>	Intestine (C).
<i>viannai</i> Pinto	Batrachian	Intestine.
sp. D'Udekem	<i>Julus terrestris</i>	Do.

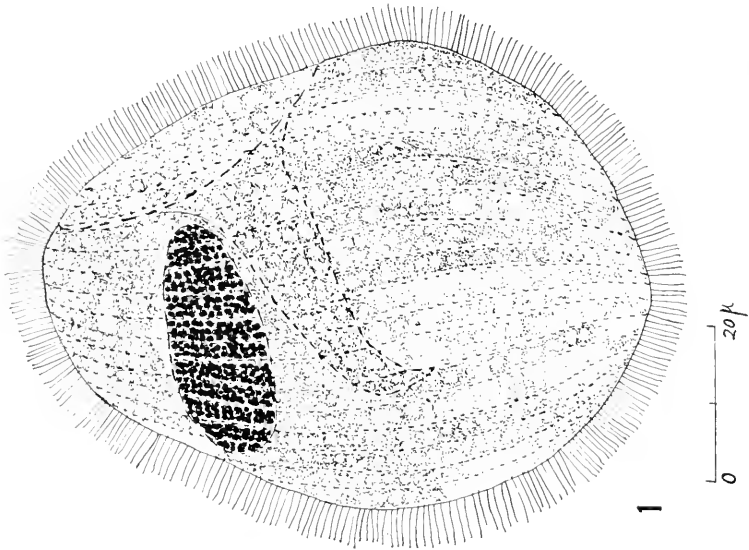
Table 1 lists the species of *Nyctotherus* that have been recorded, but the complete data on each are difficult to obtain. The letter C indicates the presence of a caryophore. Bhatia and Gulati (1927) give a list of species and a key for identification. The list is included here with some additions, but the key is not repeated. *N. osmodermæ* is closely related to *N. duboisii* (Künstler).

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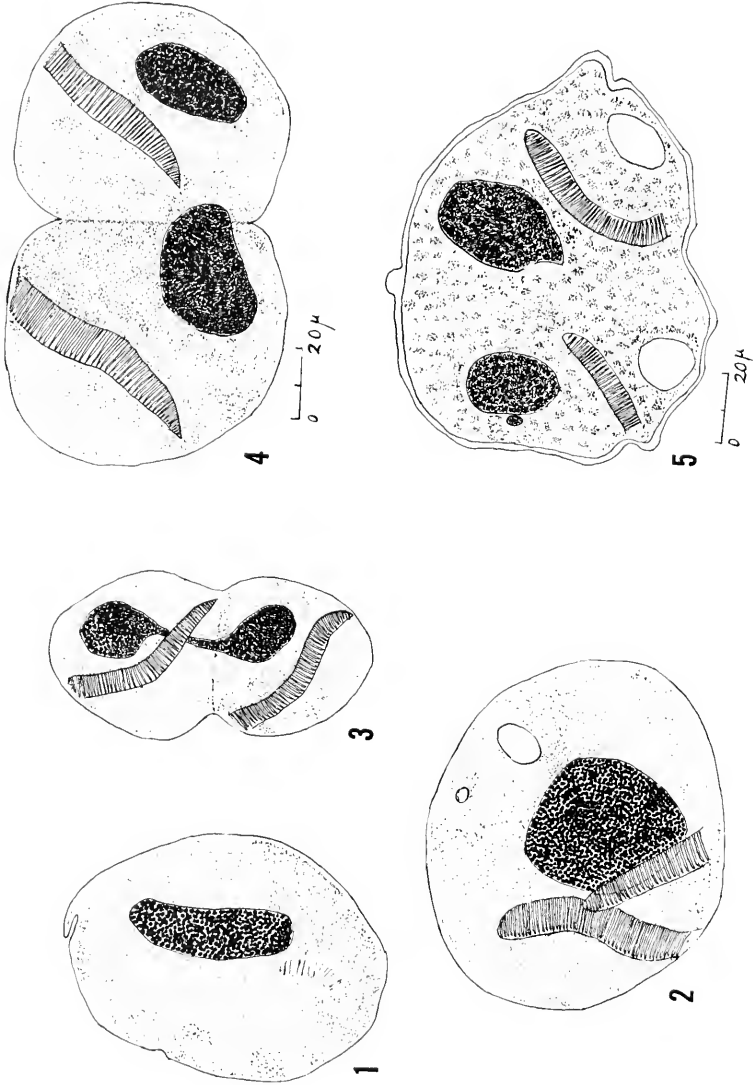
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1

NYCTOTHERUS OSMODERMAE. NEW SPECIES.

1, External view and structure; 2, internal view and organelles.



NYCTOTHERUS OSMODERMAE, NEW SPECIES.

1. Disappearance of organelles, and elongating nucleus. 2. Formation of new organelles, and old nucleus intact. 3. Division of nucleus and cell body. 4. Daughter nuclei formation completed and cell dividing. 5. Micronucleus and vacuoles prominent.

A NEW FRESH-WATER SPONGE FROM SOUTH CAROLINA¹

By JAMES T. PENNEY

University of South Carolina, Columbia, S.C.

The first specimen of the new species of *Spongilla* described herein, containing gemmules, was collected from Horseshoe Pond in Lexington County, S.C., on December 3, 1930. Since then numerous specimens have been taken throughout the year for experimental purposes, all from shallow water. All were exposed to light and were green. This *Spongilla* grows on stems and leaves of various water plants that inhabit the pond and on dead twigs. It is relatively firm in texture and has a wide range in size. The largest specimen measured 12 cm long and 3 cm wide in the thickest part.

Genus SPONGILLA Lamarck

SPONGILLA DISCOIDES, new species

Gemmules.—These are dark brown, owing to the color of the chitinous coats. They occur singly throughout the sponge but are not abundant. Their shape is quite different from that of any described gemmule, as they are biconvex disks (figs. 1, 2). There is no foraminal aperture. They range in size from 348μ to 376μ in diameter by 110μ to 130μ at the center of the disk. The granular zone is confined to the peripheral region of the disk (fig. 1, *a*), and the air cells that make up this zone are large. The inner and outer chitinous coats are well developed and are closely applied to one another on the side of the discuslike gemmule cell mass (fig. 3). Near the edge of the discus, however, the two chitinous coats diverge, the inner coat remaining closely applied to the cell mass (fig. 3, *b*). The outer coat of one side of the disk meets that of the other side at the rim of the whole disk and forms a ridge (fig. 2, *a*). The outer surface of the outer chitinous coat is raised into ridges, which anastomose with one another to form polygons (fig. 1, *b*). In section these ridges show as projections from the outer coat (fig. 3, *d*).

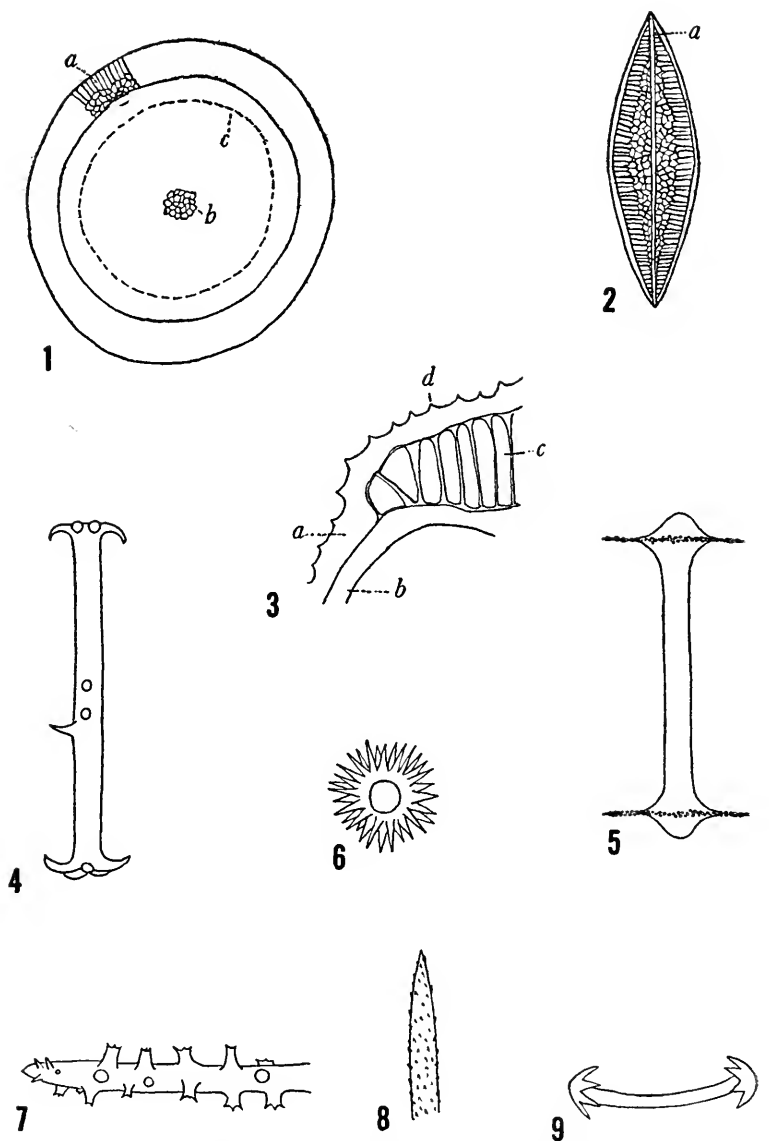
¹This paper is a result of work that has been prosecuted with the aid of a grant from the National Research Council.

The space thus formed in this region between the inner and outer chitinous coats is filled with the air cells. In the regions where the two coats separate the air cells are in a single layer (fig. 3, *c*), but as the coats become more widely separated the cells are in several layers. This granular zone ranges from 48μ to 56μ in thickness. It is not charged with, nor is the gemmule surrounded by, gemmule spicules.

Skeletal spicules.—There are two types of skeletal spicules, both of which are spined. Those of one type, which are the more abundant, are slender and slightly curved. They taper to sharp points at both ends and bear numerous minute spines. These spines are perpendicular to the spicule at the center, but on each side of the center they are curved toward their respective ends of the spicule (fig. 8). While many of these spicules lie singly in the parenchyma, the majority are collected into bundles, which mark out a rough framework for the sponge. These bundles contain 2 to 10 spicules. Spicules of this type range from 185μ to 245μ in length by 3.9μ to 5.8μ in width. Those of the other type of skeletal spicule are straight and taper toward points at both ends. They bear prominent spines, which are subdivided at their extremities into 2 or 3 smaller spines (fig. 7). These spicules range from 135μ to 143μ in length by 3.5μ to 4.4μ in width. They are not abundant.

Dermal spicules.—These are small equibirotolates. Each rotule consists of a small inturned disk bearing 6 or 8 curved hooks, which are directed toward the rotule at the opposite end of the spicule. The shafts may be either straight or curved. They are entirely free from spines (fig. 9). These small birotulates measure from 19μ to 27μ in length by 1.75μ in diameter. The rotules range from 5μ to 7μ in diameter, including the hooks. These spicules are abundant in all specimens but are especially so in young sponges.

Flesh spicules.—There are two types of flesh spicules, both of which are equibirotolates. In one type the rotules consist of 4 or 6 incurved hooks. The shafts are straight and bear several slightly curved spines, which are as long as the hooks of the rotules (fig. 4). These spicules measure 45μ to 55μ in length by 2.6μ to 3.8μ in diameter. The rotules are 8.7μ to 10.4μ in diameter. Both types of flesh spicules are abundant, but the type just described is more abundant than the following one. The rotules of the other type are knoblike and bear numerous spinelike rays, which are not all at one level (figs. 5, 6). The shafts are straight and may bear 1 or 2 minute spines. These spicules range from 35μ to 45μ in length by 3μ in diameter. The rotules range from 11μ to 20μ in diameter, including the spines.



FIGURES 1-9.—*Spongilla discoides*, new species: 1, Side view of gemmule (*a*, granular zone; *b*, polygons on surface of outer chitinous coat; *c*, area within disconnected line missing on one side of empty gemmules), $\times 113$; 2, view of gemmule from edge of discus (*a*, rim formed by union of outer chitinous coats from both sides of gemmules), $\times 113$; 3, portion of a section through gemmular coats (*a*, outer chitinous coat; *b*, inner chitinous coat; *c*, air cell; *d*, ridges of polygons of outer chitinous coat), $\times 460$; 4, 5, flesh spicules, $\times 1,000$; 6, rotule of a flesh spicule similar to but smaller than the one shown in figure 5, $\times 1,000$; 7, 8, skeletal spicules, $\times 1,000$; 9, dermal spicule, $\times 1,000$.

Remarks.—The two types of skeletal spicules and the two types of flesh spicules readily establish the new species. The two types of flesh spicules resemble closely the gemmule spicules of *Heteromeyenia ryderi baleni* found in the same pond (Penney, 1931). It was at first thought that they were identical and that the *Heteromeyenia* spicules had been deposited in the parenchyma of the *Spongilla*. This idea, however, was soon given up, as the spicules are present in abundance in all the *Spongillas* examined. As a final proof, young sponges grown from the "reduction" (reduction bodies) of Müller (1911) show both mature spicules of these types and many developmental stages.

There are no gemmules heretofore described that are in the shape of a discus or in which the two chitinous coats are applied to each other over a greater part of the surface, or in which the granular zone is restricted to a particular portion of the gemmule. For a proper understanding of the true relationship of the chitinous coats, it will be necessary to study developmental stages. According to the diagnosis of the genus *Spongilla* given by Potts (1887), the gemmules are surrounded by spined acerates and the skeletal spicules are rarely spined. Gee (1930) gives a list of the known fresh-water sponges. Of these, reference to one genus only is probably necessary. Annandale (1913) describes the gemmules of *Nudospongilla* as "devoid of foramina, pneumatic coat and spicules, adherent at the base of the sponge, ovoid in outline and somewhat flattened." In the description of the type, *N. coggini*, he states that "gemmules of moderate size, few in number, flattened at the base, dome-shaped above, with a central indentation or concavity; their chitinous coat thin and brittle, covered by a delicate outer membrane in continuity with the basal membrane of the sponge." A new genus may be indicated, but until more sponges of a similar nature are described, it is better to consider this sponge as a greatly modified *Spongilla*.

This sponge has been reported before by the author (Penney, 1931) as an unidentified species of *Spongilla*, but it was not described. As stated above, collections were made throughout the year. During the summer of 1932 gemmules of this sponge were found in abundance floating at the surface of the pond. It is quite probable that this indicates the disintegration of a great number of sponges, as the pond, because of an extraordinary dry season, was greatly reduced in size, the shore line having retreated about 20 feet during the summer. Many of these floating gemmules were empty. No gemmules were observed in the process of liberating their contents, but the method by which this is done might be inferred from the appearance of the empty ones. A portion of one side of each gemmule, not including the granular zone, was lacking

(fig. 1, *c*). Since the gemmule has no foraminal aperture, one might reach the conclusion that at the time of maturity one side of the gemmule was ruptured and the contents liberated.

Holotype.—U.S.N.M. no. 22194 (1 specimen and 3 slides), from Horseshoe Pond, Lexington County, S.C.

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ADDITIONAL NOTES ON THE BIRDS OF HAITI AND THE DOMINICAN REPUBLIC

By ALEXANDER WETMORE

Assistant Secretary, Smithsonian Institution

and

FREDERICK C. LINCOLN

Biologist, Bureau of Biological Survey, United States Department of Agriculture

INTRODUCTION

In continuation of biological studies in Hispaniola under the Smithsonian Institution, we were engaged in field investigations in Haiti and the Dominican Republic in the spring of 1931, being occupied principally with birds but making supplementary observations in other fields as opportunity presented. Our principal objective was the exploration of certain areas from which information and specimens were particularly needed. The expenses of field work were borne by the Smithsonian Institution, with certain assistance from Dr. W. L. Abbott, whose interest in this region has been of long standing. The Bureau of Biological Survey of the United States Department of Agriculture cooperated in this work through the detail of the junior author, particularly to permit study of the spring migration among migrant birds from North America on this interesting island.

ITINERARY

We arrived in Port-au-Prince, Haiti, on the morning of March 22, 1931, landing from the Panama Steamship Line S.S. *Ancon* in the blaze of morning sunshine usual at this season of the year. Through the courtesy of Captain Davis, captain of the port, our equipment was expeditiously passed through customs, and we were soon comfortably established ashore. At noon with friends we visited Kenshoff, driving up by automobile, to make our first observations, in part over a trail traversed laboriously on foot during an earlier visit by Wetmore in 1927.

Through the courtesy of the authorities, necessary permits for our work and other details were soon arranged. On March 25 we traveled by automobile with S. W. Parish to Cap-Haïtien, and continued next day to the sisal plantation of the Haitian American Development

Co., near Terrier Rouge, where we were hospitably received by Mr. and Mrs. R. L. Pettigrew and were given quarters in the guest house, which was on an eminence overlooking the bay at Fort Liberté. The thorny scrubs of the level plain had been cleared from an area of 7,500 acres to allow the planting of sisal, and a further clearing of like extent was at the time under way. On March 27 and 30, we visited the low, double-pointed hill called Morne des Mammelles (pl. 1), located a short distance west of the bay, being the only eminence in an otherwise level landscape, where we found the flat-billed vireo and the piculet. On March 29 we went by launch to old Fort La Bouque at the entrance of the bay. Birds were abundant all through this region. On March 31 we returned to Port-au-Prince, stopping en route at Pont de l'Estère to secure a specimen of the tawny-shouldered blackbird and of the thick-knee.

Through the courtesy of Colonel Cutts and Maj. J. E. Davis, U.S.M.C., in the early morning of April 3 the senior author made a reconnaissance by air of the La Hotte Mountain Range at the western end of the Tiburon Peninsula with Sergt. R. A. Trevelyan as pilot. We left the flying field at Port-au-Prince at sunrise, traveling west along the coast, and then crossing to Aux Cayes, which gave a point of departure for the trip into the interior. Fortunately the morning was clear, as the peaks of La Hotte are ordinarily hidden in clouds, and the mountain came into sight as soon as we had crossed the center of the peninsula, bulking on the horizon high above any of the other ranges. Beyond Camp Perrin we turned directly toward La Hotte, crossing above a wonderful stand of dense rain forest that covered the eastern and southeastern slopes of the mountain, beginning apparently at about 1,000 meters altitude or higher. Obviously the section was one of heavy rainfall. To the north of the mountain were rolling ridges with considerable human habitation. Crossing over Desbarriere, Trevelyan turned directly toward the north face of the mountain, flying above a deep intervening valley. The northern slope of the Pic de Macaya was covered with pine forest of large size, without sign of trails or human habitation. A deep valley separated Pic du Formon from Macaya, the tree growth there being dense and principally rain forest. La Grande Colline, the third peak in the mountain complex, lower in elevation than the other two, was covered principally with pine. Traveling first at a few hundred feet elevation to get the lay of the land, we later descended so that the airplane traversed the deep intervening valleys and crossed the highest points of all three peaks only a few feet above the trees. On the northwest point of Macaya, the highest of the three, was a small clearing made by Engineer Dejour the year previous. We crossed and recrossed over slopes whose wild beauty it is difficult to describe, looking down into the dark, wet depths of jungle, where there was no indication

that man had ever set foot, and which the imagination peopled with any manner of strange and unusual birds. Both Macaya and Formon are long ridges with little plateau area at the top, extending east and west with steep pitches on the eastern faces.

We left the mountain finally from the south face of Formon. From Port à Piment a valley with many habitations leads up to a rolling cultivated plateau, apparently the region designated on maps as Les Platons, which offers easy access to the base of Formon and the rain forest on the southwest face of the mountain.

With knowledge gained from this reconnaissance, which through the intelligent cooperation of Sergeant Trevelyan was most complete, we proceeded with arrangements for field work in the La Hotte section, one of the major objectives of the expedition.

On April 5 we left Port-au-Prince by automobile with S. W. Parish and with H. W. Krieger, of the National Museum. We arrived that afternoon at Aux Cayes, where we spent the night, and continued next day by way of Camp Perrin to Post Avancé, which marked the end of construction passable for vehicular traffic on the proposed highway to Jérémie. From here Mr. Krieger returned, while we organized a pack train with the assistance of Engineer Dejour, who had worked in the La Hotte area, and whose services had been obtained through the assistance of Commander Duncan, of the Travaux Publique. Post Avancé has an altitude of approximately 450 meters. The work of arranging the packs was slow as usual, and it was 2 o'clock in the afternoon before we were on our way. Our route followed the line established for the continuation of the motor road, going steadily upward, with views of the sea and Île à Vache in the distance. At Tombe Cheval we descended a steep and muddy pitch in a blinding rain, and about 5 o'clock reached the summit of the ridge at Geffrard, where we stopped for the night at a little native hut, the fog and rain still continuing. We started to erect a tent but were given the use of one room in a little dirt-floored house, where there was space for our cots and where we were under shelter. Our camp was at 740 meters.

The following morning we were out at dawn and, after the usual difficulties besetting this type of travel, were under way a little after 9 o'clock. A slide had blocked the trail a short distance ahead, making necessary a detour through a dense rain forest over steep trails, deep in mud, where our animals slipped and plunged and we were at times compelled to descend and walk for our own safety. In places mudholes that we could not avoid were belly-deep on our mules. The rain forest extended to Donté, the route leading through the edge of the great expanse of forest that had been seen from the air. The trail had been blocked at Donté to prevent passage, but we filled in the cut and proceeded without other incident than considerable loud talk. The slope beyond became steadily steeper until finally we had

to walk while the packs were removed and carried by porters. From Geffard we had descended to 250 meters, but on this high point we were again at 740 meters elevation. While waiting at the top of the ridge for part of the outfit, we collected a fine cloud swift.

Rain began again, and we crossed a series of stony ridges grown with low trees where habitations were few, to stumble and slip finally down a long pitch into the cultivated valley at Les Glaces, where we forded the stream of this same name. At Les Glaces we found a scattered settlement of 40 or 50 houses whose inhabitants were amazed to see white men. With darkness approaching we continued over muddy trails until we came out suddenly on the broad highway that was being pushed across from Jérémie, and in a blinding rain reached the settlement of Deron, where we were hospitably received in the house of Lifaite Loco, Chef de Seccion, who placed a room at our disposal and provided quarters for our men. The terrific down-pour that began with our arrival continued without abatement until 4 o'clock the following morning, so that we were thankful for the galvanized-iron roof over our heads in spite of the tremendous noise that the water made upon it.

As the streams were so high that fords were impassable, we remained until April 8 at Deron to make collections and to dry out our outfit. The region was an undulating plateau rising in high hills, on which were small areas of the original forest. Elsewhere the land was cultivated or planted to coffee. The elevation at the house of Loco was 620 meters.

We left Deron at 1:15 on the afternoon of April 9, having been delayed by waiting for the return of a man sent the previous day to Corail for supplies. Our way led over rolling ridges covered with coffee, and supporting a considerable population. Late in the afternoon we came out on a knife-edged ridge, with a trail following along the top and the slopes falling away abruptly on either side, and climbed a steep pitch to a pointed knoll grown with pines. This was the Bois Pin Lacadonis, and as we rested we admired the open stand of pines in contrast to the dense jungle growths that we had crossed previously. After fording a small stream below there, part of the outfit took the wrong trail and was soon in trouble on the steep slopes, with animals down so that part of the loads had to be carried by hand. While we waited we watched circling flocks of the mountain swallow (*Lamprochelidon sclateri*) and collected one for a specimen. With the outfit assembled once more, we continued as rapidly as possible over muddy trails until we arrived at dusk at the little group of houses known as Bois Lacombe, where we were cordially received by a friendly old man and were given a tiny little house that had barely room for our three cots side by side. The elevation there was 925 meters.

At dawn the following day we were awakened by the songs of a great multitude of gray robins. Two pack animals were exhausted and were left behind in the care of a native, while their burdens were taken by porters. These arrangements took so much time that it was after 11 o'clock before we were moving through pleasant sunshine down to three crossings of the Rivière des Roseaux (pl. 1), where the fords followed ledges of rock along which our animals scrambled like goats with narrow escape from slipping into the deeper water at either side. The stream was at 680 meters elevation, and on leaving it we traveled up steep slopes where a multitude of trails led through tangled scrub, causing much discussion among the men as to the proper one to follow, until we were again at 900 meters altitude. Occasional ridges were grown with pine, but this was not abundant. Gray robins, honeycreepers, and an occasional migrant warbler were noted from our mules. We heard the calls of narrow-billed todies and trogons, and parrots and pigeons were abundant. We remarked on the entire absence of crows and paroquets. At 3:15 we came to the half dozen huts marking the settlement of Desbarriere, on a narrow ridge at an elevation of 985 meters. In view of the uncertainty as to what was ahead of us, we stopped here for the night, obtaining the use of a little hut where we were very comfortable. The steep-sided ridges at this point were cultivated, having little natural forest except on the highest hills. Beyond a narrow, pine-covered ridge, opposite our caye, we had glimpses through driving clouds of fog of the huge bulk of the Pic de Macaya (pl. 2), its forest-covered slopes appearing dark and mysterious through the shifting veil of mist, which finally closed into a blank wall of cloud and spread across to where we ourselves were standing.

The following morning, April 11, we awoke to a drizzling rain that made the clay soil of the steep trails slippery and treacherous. Finally the sun appeared, and in due time we were under way; we climbed with difficulty to the summit of a hill at 1,090 meters elevation, continued across these high slopes to Amiel, and descended finally to the Rivière Anglais, where at the little group of cayes called La Cour Z'Anglais we came to the end of trails that mules could travel. We camped here in a box canyon beside the stream at an elevation of only 565 meters. The following morning it was necessary to secure porters to continue our journey, which occasioned some difficulty, as, though arrangements had been made at Desbarriere for a number of men, they appeared under the leadership of a wily old gentleman who demanded an exorbitant price for their services which we refused to pay. It was afternoon before we were finally on our way with part of our outfit, leaving the rest in storage at La Cour Z'Anglais.

Rain began to fall as we started, and we climbed with difficulty over narrow trails that led up and down through coffee plantations, little

fields, and tracts of forest over a series of ridges whose slopes in places were almost precipitous. Rain fell steadily. Our train of porters gradually separated, because of differences in weight in loads carried and the capabilities of the individual men for this kind of travel. Darkness overtook us on the mountain slope, and we found shelter in a small caye where we spent the night, sitting over a little fire, brewing tea, and sleeping as we could. The following morning, April 13, we reached our objective at the little group of three huts called Caye Godet, the last human habitation on the higher slopes of the Pic de Macaya (pl. 2). At 1,275 meters at the edge of the rain forest we dug out a little level space and pitched our tent. Below us the mountain descended steeply into a deep valley with slopes cultivated in bananas, sweetpotatoes, coffee—grown without shade because of the almost continuously clouded sky—and other crops. Across rose the steep pitches of La Grande Colline, called locally Changelange, and ahead we had a glimpse of the forested slopes of Pic du Formon, the third of the peaks of La Hotte. La Grande Colline had an extensive stand of pine, while rain forest covered Formon.

Above our camp on Macaya, rain forest extended to 1,800 meters elevation, where it was replaced by a stand of tremendous pines 4 to 6 feet in diameter, their lower limbs cloaked in moss and epiphytes, and the ground beneath covered with dense growths of dripping bracken.

From Caye Godet a trail extended to the lower edge of the forest, and it was practicable to follow the crest of a narrow ridge to the summit of the mountain. The peak extended in a general east and west direction, with a very narrow plateau at the summit. To 1,950 meters elevation the ascent was very steep and difficult, but beyond was a more gently sloping shoulder leading to the narrow plateau mentioned at 2,120 meters, rising slightly higher toward the west. Limestone was exposed at the altitude last named. This upper portion of the trail had been opened by Haitian engineers of the Travaux Publique, but at the time of our visit signs of their passage had been almost obliterated. Since the summit had at some time been swept by fire, in some years there must be a reduction in precipitation. We climbed to the summit on April 17, worked halfway along the elevated ridge, and on April 20 ascended again to the eastern end. Because of the dense growth collecting and observation were difficult, and on the whole the mountain was less interesting than the high ridge of La Selle, visited by Wetmore in 1927.

Rain fell daily, and heavy mists covered the mountain slopes for the greater part of the time. Mr. Parish left for the coast on April 15, accompanied by Dejour, and on April 22, with our observations completed, we broke camp and transported our outfit by porters to La Cour Z'Anglais, where we arrived about noon. We had expected to

continue farther, but heavy rain made it inexpedient to attempt the steep climb out of this valley, and we remained until the following day. At noon on April 23 the last of the outfit reached Amiel, and we continued to the north of Desbarriere over trails that alternated in liquid mud and rock. That night we camped at Bois Lacombe, and continued on April 24 through Les Caves to Les Glaces, where we made camp above the crossing of the stream. On April 25 we reached Post Avancé, and the following noon were at Camp Perrin, where we transferred our outfit to a decrepit motor truck and continued to Aux Cayes.

On April 27, through the courtesy of Lieut. Charles Klein, in command of the Garde d'Haiti at Aux Cayes, we were given the use of a launch, and in it we crossed to Île à Vache, where we made camp back of the sandy beach of the little land-locked harbor of Feret Bay (pl. 3). After the muddy trails of La Hotte it was a welcome sensation to be clean and dry and to walk about on level ground.

Rolling hills rising 25 to 30 meters cover the western half of the island, while the eastern portion is low and swampy. The coast is irregular, with low cliffs exposed at the headlands and several small bays having sandy beaches. Though much of the island is cultivated, there were numerous tracts of scrub and low forest. Small birds were common, and we were interested to note the presence of Cape May warblers, barn swallows, and other North American migrants. On April 30, S. W. Parish joined us again. On May 1, we returned to Aux Cayes, and continued by automobile to Port-au-Prince, arriving late in the evening.

On May 5 we went by motor to Jaemel, making collections at several points. The Trouin Valley, through which the road crosses, is of interest as marking the western limit of the Massif de La Selle.

On May 6 we left by automobile for the Dominican Republic, crossing by way of Las Cahobes and Belladère over a road made difficult by heavy rains. At Comendador, through personal letters from Gen. Rafael Trujillo, President of the Dominican Republic, we were courteously received. We continued to San Juan, where we spent the night, and on the next day we followed the main highway east to near Azua, and then turned off for Barahona, entering a dry, desert section grown with a variety of cacti and other desert plants that proved so interesting that it was late in the afternoon before we came down over the rough road through the hills into the canefields filling the valley of the Río Yaque del Sur. At Barahona, Frank Warmoth, manager for the Barahona Co., devoted to the production of sugar, and his assistants, John L. Segall and George Hamor, received us most hospitably and assisted in obtaining a boat for a journey to Beata Island. On May 9 we collected south of Barahona at La Cienaga, 15 kilometers distant, where we found considerable growth of forest. At 7 o'clock

that evening we left Barahona on the *Rosita*, a 10-ton single-masted sailboat carrying two jibs, with a crew of three men. With a favorable wind we reached the island of Beata about 1 p.m. on May 10. The little cove at Oerik on the northern side of the island had a sandy beach above which stood two small houses. Don Eduardo Echevaria, in charge of the salt works, not now in operation, received us hospitably and gave us a room in one of his houses, a welcome that was much appreciated, as the intense sun would have made living in a tent almost unbearable. Beata Island is low and has a slightly undulating surface composed of a mass of limestone much eaten by erosion, so that the ground is rough and broken. Thorn-covered trees, bushes, and vines grew from scanty soil accumulated in crevices in the rock, and with abundant cacti formed a jungle so dense that it was to be penetrated for any distance only along trails cut laboriously into the interior. In a few places there was a thin covering of soil, but over most of the island the bare rock was exposed. The coast was bare and open, with stretches of sandy beach alternating with low, rocky headlands. Though the West Indies Pilot gives an elevation of 100 meters, the highest points we observed were not more than 35 meters.

Our field work was carried on principally early in the morning, as by 11 o'clock the blazing sun beating down on the island made any physical exertion arduous, and even in the earlier part of the day the heat was at times most oppressive. Snakes were fairly common, and lizards abounded, some of those taken proving new to science, as did also several forms of land shells that we collected. Within 15 minutes after leaving camp on our first morning afield we obtained a form of *Microligea* that was recognized instantly as being unknown. On May 14 we went out in the boat to five isolated limestone rocks lying in a semicircle 2 to 5 kilometers offshore. Three of these were 30 to 45 meters long by 15 meters wide, elevated 6 to 12 meters above the sea. Bridled terns and noddies nested there, and we found a few boobies.

We left Beata Island about 5 p.m. on May 15, but on account of calms and headwinds did not reach Barahona until 2 a.m. on May 18. On May 19 we started for Haiti, stopping 6 kilometers north of Habanero, beyond the Río Yaque del Sur, to collect in the cactus-grown desert (pl. 4). That night we were in San Juan, Dominican Republic, and on the following morning, May 20, crossed into Haiti, pausing in the rolling plains area east of Las Cahobes to collect a small series of grasshopper sparrows. We arrived in Port-au-Prince that evening.

On May 20 we collected in the region of Thomazeau, visiting Source Caïman and getting a view of the shore of the Étang Saumâtre (pl. 6), with a flock of flamingos standing in the shallow water. The great swamp at Trou Caïman was entirely dry. The following day we



VIEW ACROSS SISAL FIELDS TOWARD MORNE DES MAMMELLES.
Near Terrier Rouge, Haiti, March 30, 1931.



CROSSING THE RIVIÈRE DES ROSEAUX.
Below Bois Lacombe, Haiti, April 10, 1931.



NEAR BASE OF PIC DE MACAYA.
From Desbarriere, Haiti, April 11, 1931.



HUTS AT CAYE GODET.
On Pic de Macaya, Haiti, April 21, 1931.



FERET BAY.
Île à Vache, Haiti, April 29, 1931.



BAY AT WESTERN END OF ÎLE À VACHE.
Haiti, April 30, 1931



RÍO YAQUE DEL SUR

At Boca del Baos, Dominican Republic, May 19, 1931.



DESERT VEGETATION.

Between Barahona and Azua, Dominican Republic, May 19, 1931.

visited a region of stony slopes 5 kilometers west of L'Arcahaie, which completed our work in the field, as rains had been steadily increasing until the roads out of Port-au-Prince became impassable. We sailed for New York on the S.S. *Ancon* on May 27.

THE AVIFAUNA OF LA HOTTE

The only ornithological work in the La Hotte area prior to our visit was that of R. H. Beck, who traveled in the interest of the American Museum of Natural History. His itinerary, taken from his manuscript journals, available through the kindness of Dr. F. M. Chapman and Dr. R. C. Murphy, is as follows:

On June 15, 1917, Beck came to Les Anglais, and on June 18 proceeded inland up steep slopes where he found coffee growing to 1,200 meters. He camped at the last available water above the highest native hut. Beyond there were no trails, and progress was impeded by trees blown down by a recent hurricane. On the following day he cut a trail to the top of a long ridge leading toward a high peak and continued until he came to two pines. On returning to his camp at noon he found that his men had deserted him. On June 21 he moved to another site and on the following day cut a trail to near the level of pines. On June 24 he again climbed to the summit of the ridge near the base of the peak, returning June 26 to Port à Piment. On July 1 he went again inland, and on July 4 cut another trail along the ridges toward the high peak.

From the fact that Beck came into this region from Les Anglais and Port à Piment, it is evident that his collections were made on the slopes of La Grande Colline. From his specimens Wetmore described *Calyptophilus tertius tertius*, the only bird now known to be peculiar to this region.

From the viewpoint of its avifauna on the basis of somewhat limited present knowledge, La Hotte is rather disappointing, as its interest comes principally from those forms that do not occur. Among the birds peculiar to the higher mountains of the island we found only Chapman's ground warbler (*Microligea montana*), the Hispaniolan elaenia (*Elaenia albicapilla*), and Sclater's swallow (*Lamprochelidon sclateri*). The paroquet was not observed, though parrots were common, and the Hispaniolan ground warbler (*Microligea palustris palustris*) was absent. It would appear that the region has been one of isolation to which certain widespread forms have not penetrated, in most cases probably because of the dense rain forest that has not allowed the proper environment. Isolation is, however, the only explanation to be given for the absence of *Microligea palustris palustris* as the entire section is well suited to the needs of this form.

The foregoing remarks must not be construed to indicate that this difficult mountain region is barren ornithologically. The abundance

of solitaries, the sharp-shinned hawks of its forests, the swallows and swifts that play over the mountain slopes, and the variety of other birds that are constantly about are of perennial and never-failing interest. The little observation that has been carried on there has been on Macaya and La Grande Colline. In addition to further investigations of the birds of these mountains there still remain the dark forests of Formon, known at present scientifically only to the botanists Ekman and Barker, who cut a trail to the summit and there collected plants.

THE BIRDS OF ÎLE À VACHE

Île à Vache, between 10 and 12 kilometers distant from the main shore, opposite the town of Aux Cayes, is about 12 kilometers long by 5 or a little more wide. The shoreline is irregular, being cut by several bays. The western end is elevated and rolling, with low hills, partly cultivated and partly in scrub, none of the tracts of forest being extensive. The eastern section is low and swampy and has not been carefully investigated. There are no doubt several swamp-loving birds still to be reported from this area. The Parish-Smithsonian Expedition of 1930 made the first collections on this island, their studies¹ being so interesting as to make it desirable to do further work. Our stay was productive, adding a number of forms to the previously known list.

The bullfinch (*Lorigilla violacea parishi*) and the palm tanager (*Phaenicophilus poliocephalus tetraopes*) are peculiar, differing slightly from those of the main island. In view of the proper ecologic conditions that exist, it is curious to note the absence of such species as todies, woodpeckers, and palm-chats, to mention only a few among the forms endemic on the main island so closely adjacent. The known bird list now totals 54 forms, as follows:

Antillean grebe.....	<i>Podilymbus podiceps antillarum.</i>
Yellow-billed tropic-bird.....	<i>Phaëthon lepturus catesbyi.</i>
West Indian brown pelican.....	<i>Pelecanus occidentalis occidentalis.</i>
Frigate-bird.....	<i>Fregata magnificens rothschildi.</i>
Louisiana heron.....	<i>Hydranassa tricolor ruficollis.</i>
Little blue heron.....	<i>Florida caerulea caerulescens.</i>
West Indian green heron.....	<i>Butorides virescens maculatus.</i>
Yellow-crowned night heron.....	<i>Nyctanassa violacea violacea.</i>
West Indian tree-duck.....	<i>Dendrocygna arborea.</i>
West Indian red-tailed hawk.....	<i>Buteo jamaicensis jamaicensis.</i>
Ridgway's hawk.....	<i>Buteo ridgwayi.</i>
Osprey.....	<i>Pandion haliaëtus carolinensis.</i>
Hispaniolan sparrow hawk.....	<i>Falco sparverius dominicensis.</i>
Hispaniolan clapper rail.....	<i>Rallus longirostris vafer.</i>
Antillean gallinule.....	<i>Gallinula chloropus portoricensis.</i>

¹ Wetmore, A., Birds collected in Cuba and Haiti by the Parish-Smithsonian Expedition of 1930. Proc. U.S.Nat. Mus., vol. 81, art. 2, July 22, 1932, pp. 1-40; pls. 1-7.

Spotted sandpiper.....	<i>Actitis macularia.</i>
Black-necked stilt.....	<i>Himantopus mexicanus.</i>
Laughing gull.....	<i>Larus atricilla.</i>
White-crowned pigeon.....	<i>Columba leucocephala.</i>
Zenaida dove.....	<i>Zenaida zenaida zenaida.</i>
West Indian mourning dove.....	<i>Zenaidura macroura macroura.</i>
White-winged dove.....	<i>Melopelia asiatica asiatica.</i>
Cuban ground-dove.....	<i>Columbigallina passerina insularis.</i>
Mangrove cuckoo.....	<i>Coccyzus minor teres.</i>
Ani.....	<i>Crotophaga ani.</i>
Palm swift.....	<i>Tachornis phoenicobia phoenicobia.</i>
Hispaniolan vervain hummingbird.....	<i>Mellisuga minima veilloti.</i>
Hispaniolan mango hummingbird.....	<i>Anthracothorax dominicus.</i>
Gray kingbird.....	<i>Tyrannus dominicensis dominicensis.</i>
Hispaniolan flycatcher.....	<i>Myiarchus dominicensis.</i>
Bank swallow.....	<i>Riparia riparia riparia.</i>
Barn swallow.....	<i>Hirundo erythrogaster.</i>
Hispaniolan cliff swallow.....	<i>Petrochelidon fulva fulva.</i>
Caribbean martin.....	<i>Progne dominicensis.</i>
Hispaniolan mockingbird.....	<i>Mimus polyglottos dominicus.</i>
Jamaican vireo.....	<i>Virco olivaceus olivaceus.</i>
Black-whiskered vireo.....	<i>Virco olivaceus barbatula.</i>
Hispaniolan honey-creeper.....	<i>Coereba bananivora bananivora.</i>
Black and white warbler.....	<i>Mniotilta varia.</i>
Hispaniolan golden warbler.....	<i>Dendroica petechia albicollis.</i>
Cape May warbler.....	<i>Dendroica tigrina.</i>
Yellow-throated warbler.....	<i>Dendroica dominica dominica.</i>
Northern prairie warbler.....	<i>Dendroica discolor discolor.</i>
Black-poll warbler.....	<i>Dendroica striata.</i>
Black-throated green warbler.....	<i>Dendroica virens virens.</i>
Ovenbird.....	<i>Seiurus aurocapillus aurocapillus.</i>
Northern water-thrush.....	<i>Seiurus noveboracensis noveboracensis.</i>
Northern yellowthroat.....	<i>Geothlypis trichas brachidactyla.</i>
Redstart.....	<i>Setophaga ruticilla.</i>
Hispaniolan grackle.....	<i>Holoquiscalus niger niger.</i>
Île à Vache palm tanager.....	<i>Phaenicophilus poliocephalus tetraopes.</i>
Yellow-faced grassquit.....	<i>Tiaris olivacea olivacea.</i>
March's grassquit.....	<i>Tiaris bicolor marchii.</i>
Parish's bullfinch.....	<i>Loxigilla violacea parishii.</i>

BIRDS OF BEATA ISLAND

Beata Island is located off the extreme southern end of the Barahona Peninsula, separated by a distance of 10 kilometers from the nearest point of the main island. The intervening channel is only $2\frac{3}{4}$ fathoms (4.9 meters) deep in the center. Five flat-topped rocks of the same formation as the island project in a semicircle off the northern coast. It is evident that Beata has had close connection with the adjacent shore, though probably it has been separated for many thousands of years. The island is about 8 kilometers long by 7 kilometers broad, and according to the West Indies Pilot has a maximum elevation of 100 meters. From our personal observation we believe that there is

some error in this, as in the northern half of the island the maximum altitude is less than 50 meters. From tree tops at the farthest point to which we penetrated we had a view of the entire island, and in the slightly undulating expanse of scrub that extended beyond our observation post we saw nothing to indicate a greater elevation, as the terrain rose only slightly in low, rolling ridges.

The island is of limestone formation (pl. 5) with the surface, though generally level, much eroded, so that the stone projects in small sharp-edged points that cut one's shoes badly. Along the north coast, projecting headlands, whose rocky points rise only a short space above the sea, alternate with sandy beaches back of which there are small, saline lagoons and areas of grass. Inland there is a solid stand of scrub growing from 3 to 10 meters tall, only occasional trees being of large diameter (pl. 5). There is much cactus, and many of the shrubs are so thorn covered that it is difficult to penetrate the interior except along two trails that have been cut recently, one of which leads a little more than halfway across the island. Certain areas have considerable soil, but over extensive sections the scrub grows from holes in the rocky surface. There are occasional small savannas in the interior grown with grass, 4 or 5 acres in extent. Water holes produce only brackish water.

Along the coast the wind-swept vegetation is low and stunted, so that it was possible to pick a way through, with some trouble, as the rock in places was much broken. The sea had undercut many ledges. Deep potholes were common, and it was necessary to walk circumspectly to avoid falling on the eroded stone.

Toward the center of the island the amount of visible soil is decidedly less than near the coast, and there are extensive sections of limestone entirely exposed. The scrub inland was lower and more thorny, and many slender-trunked palms with globular heads grew 10 meters or more in height, rising above the general tree level. Scattered West Indian birches (*Elaphrium*) with heavy trunks and limbs bulked large in the other growth.

So far as we have ascertained, the first collections in natural history to be made here were obtained by Dr. G. K. Noble, of the American Museum of Natural History, who worked here from October 1 to 4, 1922. From his material he described four new forms of reptiles. Dr. R. Ciferri visited Beata briefly in May 1926, devoting his attention principally to plants, but securing a few birds, among them being a booby that lived in captivity for some time.

During our observations we obtained a list of 50 forms of birds, which we believe includes the principal species of the island, and will be extended mainly through record of additional forms of herons and others of aquatic habit about the lagoons, and of wood warblers and other migrants from North America. One wood warbler (*Micro-*

ligea palustris vasta) we have described as new. This bird, in apparently the same form, extends through the arid scrubs of the adjacent Dominican coast, as we have specimens that we cannot distinguish from the Beata group from Trujin and Habanero. The bullfinch of Beata is smaller than that of the main island, and cannot be separated so far as we can ascertain from *Loxigilla violacea parishii* of Île à Vache. We have identified it therefore as of that race. The pearly-eyed thrasher (*Margarops fuscatus fuscatus*) abundant on Beata, is not known elsewhere in Hispaniola, though it occurs on Mona and Desecheo Islands, between the Dominican Republic and Puerto Rico. The presence of the burrowing owl is also worthy of comment. It will be noted that todies, parrots, lizard-cuckoos, woodpeckers, palm-chats, and various other birds peculiar to Hispaniola were not obtained on Beata.

Following is the known list of the birds of the island:

Audubon's shearwater.....	<i>Puffinus lherminieri lherminieri.</i>
Yellow-billed tropic-bird.....	<i>Phaethon lepturus catesbyi.</i>
West Indian brown pelican.....	<i>Pelecanus occidentalis occidentalis.</i>
Brown booby.....	<i>Sula leucogastra leucogastra.</i>
Frigate-bird.....	<i>Fregata magnificens rothschildi.</i>
Egret.....	<i>Casmerodius albus egretta.</i>
Louisiana heron.....	<i>Hydranassa tricolor ruficollis.</i>
West Indian green heron.....	<i>Butorides virescens maculatus.</i>
Yellow-crowned night heron.....	<i>Nyctanassa violacea violacea.</i>
Flamingo.....	<i>Phoenicopterus ruber.</i>
Bahama pintail.....	<i>Dafila bahamensis bahamensis.</i>
West Indian red-tailed hawk.....	<i>Buteo jamaicensis jamaicensis.</i>
Ridgway's hawk.....	<i>Buteo ridgwayi.</i>
Semipalmated plover.....	<i>Charadrius semipalmatus.</i>
Rufous-naped plover.....	<i>Pagolla wilsonia rufinucha.</i>
American black-bellied plover.....	<i>Squatarola squatarola cynosurae.</i>
Ruddy turnstone.....	<i>Arenaria interpres morinella.</i>
Eastern willet.....	<i>Catoptrophorus semipalmatus semipalmatus.</i>
Least sandpiper.....	<i>Pisobia minutilla.</i>
Pectoral sandpiper.....	<i>Pisobia melanotos.</i>
White-rumped sandpiper.....	<i>Pisobia fuscicollis.</i>
Semipalmated sandpiper.....	<i>Ereunetes pusillus.</i>
Sanderling.....	<i>Crocethia alba.</i>
Black-necked stilt.....	<i>Himantopus mexicanus.</i>
Laughing gull.....	<i>Larus atricilla.</i>
Gull-billed tern.....	<i>Gelochelidon nilotica aranea.</i>
Roseate tern.....	<i>Sterna dougalliï dougalliï.</i>
American bridled tern.....	<i>Sterna anaetheta recognita.</i>
Sooty tern.....	<i>Sterna fuscata fuscata.</i>
Least tern.....	<i>Sterna albifrons antillarum.</i>
Royal tern.....	<i>Thalasseus maximus maximus.</i>
Cabot's tern.....	<i>Thalasseus sandvicensis acuflavidus.</i>
Noddy tern.....	<i>Anous stolidus stolidus.</i>
White-crowned pigeon.....	<i>Columba leucocephala.</i>

Zenaida dove.....	<i>Zenaida zenaida zenaida.</i>
Cuban ground-dove.....	<i>Columbigallina passerina insularis.</i>
Yellow-billed cuckoo.....	<i>Coccyzus americanus americanus.</i>
Hispaniolan burrowing owl.....	<i>Speotyto cunicularia troglodytes.</i>
Palm swift.....	<i>Tachornis phoenicobia phoenicobia.</i>
Hispaniolan mango hummingbird.....	<i>Anthracothorax dominicus.</i>
Belted kingfisher.....	<i>Megaceryle alcyon alcyon.</i>
Gray kingbird.....	<i>Tyrannus dominicensis dominicensis.</i>
Hispaniolan flycatcher.....	<i>Myiarchus dominicensis.</i>
Barn swallow.....	<i>Hirundo erythrogaster.</i>
Pearly-eyed thrasher.....	<i>Margarops fuscatus fuscatus.</i>
Jamaican vireo.....	<i>Vireo olivaceus olivaceus.</i>
Hispaniolan honey-creeper.....	<i>Coereba bananivora bananivora.</i>
Beata ground warbler.....	<i>Microligea palustris vasta.</i>
Hispaniolan grackle.....	<i>Holoquiscalus niger niger.</i>
Parish's bullfinch.....	<i>Loxigilla violacea parishii.</i>

THE LIST OF HISPANIOLAN BIRDS

From our collections we have described two new forms, the Île à Vache tanager (*Phaenicophilus poliocephalus tetraopes*) and the Beata warbler (*Microligea palustris vasta*). In addition our records include the first report of the white-rumped sandpiper. These increase the known bird list for Hispaniola and its island dependencies to 222 forms, including the Hudsonian godwit collected by Ciferri in the Dominican Republic.²

ACKNOWLEDGMENTS

The success of our work has been due in large measure to friendly assistance that we received in many quarters. The American minister, Dr. Dana G. Munro, was most courteous and considerate, and with members of his staff gave freely of time and information. On our arrival in Port-au-Prince we were met by a representative of Captain Davis, captain of the port, who had arranged to pass our equipment through customs. Col. R. M. Cutts, in command of the Marine forces, was personally interested in our investigations, assisting through means that otherwise would not have been available. Through Colonel Cutts, and Maj. J. E. Davis, in charge of the Marine Corps Air Service, an aerial reconnaissance of the La Hotte region was possible, a journey that was accomplished with Sergt. R. A. Trevelyan as pilot.

Through Dr. Munro we met the President of Haiti, M. Stenio Vincent. By direction of General Williams, in command of the Garde d'Haiti, and his assistant Maj. O. P. Smith, we obtained necessary permits for our firearms, and to other friends in that service we are indebted for many courtesies. We desire to mention particularly assistance received from Lieut. Charles Klein of Aux Cayes in arrangements for our trip to Île à Vache.

² See Auk, vol. 48, 1931, p. 596.

Dr. Carl Colvin, acting director of the Service Technique, a friend of long standing, and Commander G. A. Duncan, of the Travaux Publique, gave much valued aid.

In our work in the Dominican Republic, we have, first of all, to acknowledge the interest of Gen. Rafael Trujillo, President of the Republic, who personally issued us permits for our firearms and gave us letters that were passports in our entry into the Republic and in our travel there subsequently; without this authority our work would not have been possible. At Barahona we were received with the greatest courtesy by Frank Warmoth, in charge of the establishment of the Barahona Co., and by his assistants John L. Segall and George Hamor, who entertained us during our brief stay in Barahona and assisted in arrangements for our trip to Beata.

Mr. and Mrs. S. W. Parish, friends who met us on our arrival in Port-au-Prince, were interested in all details of our investigations. In Mr. Parish on several expeditions we had a companion whose assistance was most valuable and who shared with us the vicissitudes of difficult travel with never-failing good nature.

Finally we must acknowledge our indebtedness to many friends and acquaintances in both Republics who gave kindly aid in the peculiar work of two strangers from a foreign land.

ANNOTATED LIST OF BIRDS

Order COLYMBIFORMES

Family COLYMBIDAE, Grebes

PODILYMBUS PODICEPS ANTILLARUM Bangs

ANTILLEAN GREBE

Podilymbus podiceps antillarum BANGS, Proc. New England Zool. Club, vol. 4, Mar. 31, 1913, p. 89 (Bueycito, Province of Oriente, Cuba).

On March 31, 1931, half a dozen grebes were seen on the Rivière Estère, near Pont de l'Estère. It is interesting to note that Des-courtilz³ reported this species as common near this same point in April, 1799.

Order PROCELLARIIFORMES

Family PROCELLARIIDAE, Shearwaters, Fulmars, and Petrels

PUFFINUS LHERMINIERI LHERMINIERI Lesson

AUDUBON'S SHEARWATER

Puffinus lherminieri LESSON, Rev. Zool., vol. 2, 1839, p. 102 ("ad ripas antillarum").

In the morning of May 10, 1931, three shearwaters came near our sloop when we were 5 or 6 kilometers northeast of Beata Island, and

³ Voyages d'un naturaliste, et ses observations, vol. 2, 1809, p. 264.

since they flew past several times there can be no mistake as to their identity. Three or four more were observed at daybreak on May 16, when we were offshore a short distance below Cabo Mongon on the southeastern coast of the Barahona Peninsula. We made careful search for these birds among the stones of the northern headlands of Beata and also on offshore rocks but failed to find them. It is quite probable that there is a colony on Alta Vela Island, as the birds seen came from the southward. The records are of particular interest in view of the little that is known concerning this species in this area.

It may be further noted that Audubon's shearwater was recorded on March 21 near Watlings and Fortune Islands, and again on May 28 opposite Great Inagua, in the Bahamas.

Order PELECANIFORMES

Family PHAËTHONTIDAE, Tropic-birds

PHAËTHON LEPTURUS CATESBYI Brandt

YELLOW-BILLED TROPIC-BIRD

Phaëthon Catesbyi BRANDT, Bull. Sci. l'Acad. Imp. Sci. St. Pétersbourg, vol. 4, 1838, p. 98 (Bermuda).

About the rocky headlands of Île à Vache tropic-birds were observed from April 28 to 30, particularly at one point on the western end of the island. It appeared that they were preparing to nest in crevices in the rocks, but we could discover no eggs. Several times they were observed flying in pairs over the sea, and single birds or little groups returned constantly to hover before the cliffs. Two adult females were collected on April 30. A few were seen about Raquette Cay at the eastern side of the entrance to Feret Bay. The Haitian fishermen called this bird *gannet*.

On May 10, along the eastern coast of the Barahona Peninsula, tropic-birds were recorded flying about rocky headlands between Paradis and Enriquillo. One was observed on May 14 at Beata Island.

Family PELECANIDAE, Pelicans

PELECANUS OCCIDENTALIS OCCIDENTALIS Linnaeus

WEST INDIAN BROWN PELICAN

Pelecanus Onocrotalus β *occidentalis* LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 215 (Jamaica).

One pelican was seen in the harbor at Port-au-Prince on March 22, two were observed over old Fort La Bouque at the entrance to Fort Liberté Bay on March 29, and another in the bay at Terrier Rouge, Haiti, on March 30. Around Île à Vache they were fairly common from April 28 to 30. At Oerik on the north shore of Beata



BARE LIMESTONE SHORE.

Beata Island, Dominican Republic, May 12, 1931.



LOW FOREST.

Beata Island, Dominican Republic, May 15, 1931.



ROLLING UPLAND.
Near Las Cahobes, Haiti, May 20, 1931.



THE ÉTANG SAUMÂTRE.
Near Glore, Haiti, May 22, 1931.

Island they were common from May 10 to 15 and fished steadily all day long in the schools of sardines within 50 yards of our door. We observed fully grown immature individuals with gray heads, adults with white crowns and necks, and numerous adults with the chestnut-brown necks of the breeding dress. We were told that they nested on the eastern shore of Beata.

Several were seen at Puerto Caïman below Enriquillo on May 16, and others were noted in the harbor at Barahona on May 7, 18, and 19.

Family SULIDAE, Gannets and Boobies

SULA LEUCOGASTRA LEUCOGASTRA (Boddaert)

BROWN BOOBY

Pelecanus leucogaster BODDAERT, Table Planches Enl., 1783, p. 57 (Cayenne).

On May 14 about 20 brown boobies were observed resting on isolated rocks 2 kilometers or more offshore from Beata Island, and two were taken, one being adult and the other still partly in immature dress. On May 16 a few were observed at sea between Beata and Puerto Caïman. This species is said to breed on Alta Vela Island.

This booby was also recorded on March 21 at sea near Watlings Island, in the Bahamas.

Family FREGATIDAE, Man-o'-war Birds

FREGATA MAGNIFICENS ROTHSCILDI Mathews

FRIGATE-BIRD

Fregata minor rothschildi MATHEWS, The birds of Australia, vol. 4, pt. 3, June 23, 1915, p. 280 (Aruba).

At Île à Vache from April 27 to 30 frigate-birds were seen regularly about Raquette Cay near the eastern side of the entrance to Feret Bay. One was observed at Beata Island on May 11, one at sea between Beata and Puerto Caïman on May 16, and one offshore from Paradis on May 17.

In earlier work on the birds of the West Indies, Wetmore^{3a} followed Rothschild in calling the West Indian bird *Fregata magnificens*, since birds from the Caribbean area appeared the same as the only two available from the west coast (La Paz and Mazatlan). Recently, Swarth^{3b} has investigated this matter and finds that typical *magnificens* of the Galapagos Islands seems distinct in larger size, and that specimens of the *magnificens* group from the west coast of Mexico and Lower California are the same as those from the West Indies. The latter are thus to be called *Fregata magnificens rothschildi*.

^{3a} The birds of Porto Rico and the Virgin Islands. Scientific Survey of Porto Rico and the Virgin Islands, vol. 9, pt. 3, 1927, p. 287.

^{3b} Condor, vol. 35, no. 3, 1933, pp. 148-150.

Order CICONIIFORMES

Family ARDEIDAE, Herons and Bitterns

ARDEA HERODIAS ADOXA Oberholser

WEST INDIAN GREAT BLUE HERON

Ardea herodias adoxa OBERHOLSER, Proc.U.S.Nat.Mus., vol. 43, Dec. 12, 1912, p. 544 (Curaçao Island).

One of these herons was seen on March 30 on the bay at the Fond Blanc plantation near Terrier Rouge, Haiti, and another on May 9 near Barahona, Dominican Republic.

CASMERODIUS ALBUS EGRETTA (Gmelin)

EGRET

Ardea Egretta GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 629 (Cayenne).

One egret was seen near our camp on Beata Island on May 11, and one was observed in a marshy pasture near Thomazeau, Haiti, on May 22.

HYDRANASSA TRICOLOR RUFICOLLIS (Gosse)

LOUISIANA HERON

Egretta ruficollis GOSSE, Birds of Jamaica, 1847, p. 338 (Burnt Savanna River, Jamaica).

This heron was observed at Cap-Haïtien, Haiti, on March 26, and at Beata Island, Dominican Republic, on May 12 and 15.

FLORIDA CAERULEA CAERULESCENS (Latham)

LITTLE BLUE HERON

Ardea caerulescens LATHAM, Index Orn., vol. 2, 1790, p. 690 (Cayenne).

Individuals were seen near Cap-Haïtien on March 26, Terrier Rouge on March 29, Île à Vache on April 29, and near St. Louis on April 30.

BUTORIDES VIRESCENS MACULATUS (Boddaert)

WEST INDIAN GREEN HERON

Cancroma maculata BODDAERT, Table Planches Enl., 1783, p. 54 (Martinique, Lesser Antilles).

Following are records for this widely distributed form: Cap-Haïtien, Haiti, March 26; crossing of the Roseaux River, below Bois Lacombe April 10 and 23; Île à Vache, April 27 to 30; Jacmel, May 5; San Juan, Dominican Republic, May 6; Barahona, May 9; Beata Island, May 13 and 15; Comendador, May 20; Thomazeau, Haiti, May 22; L'Arcahaie, May 23.

NYCTANASSA VIOLACEA VIOLACEA (Linnaeus)

YELLOW-CROWNED NIGHT HERON

Ardea violacea LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 143 (South Carolina).

On Île à Vache from April 28 to 30 several yellow-crowned night herons were seen, and one night after dark one came stalking down the beach past our camp. On Beata Island, the species was fairly common from May 11 to 15, being noted usually in evening in flight over the lagoons or along the coast.

Family PHOENICOPTERIDAE, Flamingos

PHOENICOPTERUS RUBER Linnaeus

FLAMINGO

Phoenicopterus ruber LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 139 (Jamaica, Cuba, and Bahamas).

On our landing at Beata Island on May 10, we were told that flamingos came to the lagoons back of the little house where we had our quarters and, after establishing our camp, on walking out in the evening we were delighted to see three stalking about in shallow water. The birds were observed here until our departure, coming and going irregularly during the day but apparently returning each night to sleep. Their tameness was a sufficient index to the remoteness of their island from the usual haunts of man, as it was a simple matter to approach the birds in the open, and when they flew they usually circled past us, at times within 30 yards' distance. We did not disturb them though it would have been easy to collect specimens. On the evening of May 15 at sunset, as we lay at anchor offshore from the tip of the Barahona Peninsula opposite Beata, nine flamingos flew slowly past with the evening light displaying their beautiful plumage to particular advantage. The sailors on our sloop said that the birds were common all through this section.

On the shores of the Étang Saumâtre, beyond Thomazeau, Haiti, on May 23, we observed 25 flamingos feeding in a long line in shallow water. Aviators in the Marine Corps told us that they saw the birds here regularly in passing by air.

Order ANSERIFORMES

Family ANATIDAE, Ducks, Geese, and Swans

DAFILA BAHAMENSIS BAHAMENSIS (Linnaeus)

BAHAMA PINTAIL

Anas bahamensis LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 124 (Bahamas).

Four pintails were seen in saline lagoons on Beata Island on May 15.

At Barahona, May 19, we examined one in cold storage that had been killed by George Hamor a month or six weeks previous at a

lagoon beyond Cabral. From all accounts this is one of the common ducks of that area.

NYROCA AFFINIS (Eyton)

LESSER SCAUP DUCK

Fuligula affinis EYTON, A monograph on the Anatidae or duck tribe, 1838, p. 157 (North America).

At Barahona, Dominican Republic, on May 19, we examined the body of one of these ducks in cold storage that had been killed a month or six weeks previous by George Hamor on a lagoon west of Cabral.

Mr. Hamor reports that ducks abound during the season of northern winter in the various lagoons and marshes of the area in question. In some years the birds begin to congregate there about the end of November but ordinarily the period of their greatest abundance comes in January and February. Several species are found of which a part, perhaps the larger part, are certainly migrants from North America. These include the lesser scaup; birds that Mr. Hamor believes to be pintails; the blue-winged teal; and probably others. The tree-duck, possibly including occasional individuals of a species other than the West Indian tree-duck (*Dendrocygna arborea*), the ruddy duck, and the Bahama pintail are included among species that breed in this region. From the large number of birds that congregate here, it appears that it will be important to investigate the matter, to determine the North American species involved and their relative abundance.

Order FALCONIFORMES

Family ACCIPITRIDAE, Hawks and Eagles

ACCIPITER STRIATUS STRIATUS Vieillot

HISPANIOLAN SHARP-SHINNED HAWK

Accipiter striatus VIEILLOT, Hist. Nat. Ois. Amér. Sept., vol. 1, 1807, p. 42, pl. 14 (Haiti).

This species was encountered only in the general region of La Hotte on the Tiburon Peninsula. On April 11, at Desbarriere, a pair flew high above the most elevated ridges, circling with set wings, or pursuing each other playfully. On April 16, at an elevation of 1,650 meters on Pic de Macaya, we collected a mated pair in heavy rain forest. In habits and actions they were exactly like the North American sharpshin. They rested among leafy branches, betraying their presence by a plaintive note, rapidly repeated, resembling *kew kew kew kew*, and were decoyed readily within gun range by squeaking. At Geffrard, on April 25, a female and two males circled together in the air above the forest.

Discrepancy in size in the two sexes makes it a simple matter to distinguish males and females when the two are seen together.

BUTEO JAMAICENSIS JAMAICENSIS (Gmelin)

WEST INDIAN RED-TAILED HAWK

Falco jamaicensis GMELIN, Syst. Nat., vol. 1, pt. 1, 1788, p. 266 (Jamaica).

This hawk was recorded at Kenscoff on March 22, and at Terrier Rouge on March 27. In the La Hotte region it was fairly common, though its abundance was difficult to ascertain because of the heavy forest. In this area it was noted at Donté, April 7; Bois Lacombe, April 10 and 24; and near La Cour Z'Anglais, April 12, 22, and 23. On the slopes of Pic de Macaya it was recorded regularly from April 14 to 21. Individuals were observed on Île à Vache on April 28 and 30; one was seen on Beata Island, Dominican Republic, on May 15; and one near Habanero, Dominican Republic, on May 19.

BUTEO RIDGWAYI (Cory)

RIDGWAY'S HAWK

Rupornis ridgwayi CORY, Quart. Journ. Boston Zoöl. Soc., vol. 2, Oct. 1883, p. 46 (Samaná, Dominican Republic).

The first of these hawks was seen on April 25 circling over heavy rain forest near Geffrard, Haiti. On Île à Vache several were observed. On April 28, low, chattering calls brought to attention one that rested on the edge of a partly completed nest in the top of a royal palm 10 meters from the ground. This bird was taken and proved to be a female. Two more were seen circling over low hills during that same forenoon, one was noted on the following day, and two more on April 30. One was observed on Beata Island, Dominican Republic, on May 11. The notes of this species are higher in pitch than those of *Buteo magnirostris* of continental America.

PANDION HALIAËTUS CAROLINENSIS (Gmelin)

OSPREY

Falco carolinensis GMELIN, Syst. Nat., vol. 1, pt. 1, 1788, p. 273 (South Carolina).

One osprey was recorded over the harbor at Port-au-Prince, Haiti, on March 22, and another on Île à Vache on April 29. The latter seems to constitute an unusually late record.

Family FALCONIDAE, Falcons and Caracaras

FALCO SPARVERIUS DOMINICENSIS Gmelin

HISPANIOLAN SPARROW HAWK

Falco dominicensis GMELIN, Syst. Nat., vol. 1, pt. 1, 1788, p. 285 (Hispaniola).

Sparrow hawks were observed regularly in the suburbs of Port-au-Prince, and their passage frequently caused some commotion among the palm-chats. They were recorded at Dessalines on March 25,

at Trou on March 26, and at Terrier Rouge on March 27 and 30, where one was observed repeatedly attacking a red-tailed hawk. On April 5, near Aquin, one was seen carrying a lizard nearly a foot long. In the open, settled region about the base of the La Hotte Mountains the sparrow hawk was common, and was recorded at Deron, April 8; from Deron to Bois Lacombe, April 9; at Desbarriere, April 10; and from Desbarriere to La Cour Z'Anglais, April 11. None was found on Pic de Macaya, and the bird does not appear to find haunts to its liking in rain-forest areas. On our return one was seen above the crossing of the Roseaux River below Bois Lacombe on April 23, and another at Geffrard on April 25. On Île à Vache the birds were fairly common, and one was taken on April 29.

Sparrow hawks were recorded further at Las Matas, Dominican Republic, May 6; between San Juan and Barahona, May 7 and 19; and at Barahona, May 19. They were common near Thomazeau, Haiti, May 22, and near L'Arcahaie, May 23. None was observed on Beata Island, though they may occur there locally.

Order GALLIFORMES

Family NUMIDIDAE, Guinea-fowl

NUMIDA GALEATA Pallas

GUINEA HEN

Numida galeata PALLAS, Spicilegia zoologica, vol. 1, fasc. 4, 1767, p. 13 (based on domesticated bird).

Guineas were seen near L'Arcahaie, Haiti, on March 25, and at Pont de l'Estère on March 31 two flocks were found feeding in partly open fields among scattered growths of mesquite. When flushed, they flew high over the trees. On May 20, one was observed from the car on Morne à Cabrits, and on May 23 one was seen near L'Arcahaie. At this season they were reported to be nesting.

Order GRUIFORMES

Family ARAMIDAE, Limpkins

ARAMUS PICTUS ELUCUS Peters

LIMPKIN

Aramus pictus elucus PETERS, Occ. Pap. Boston Soc. Nat. Hist., vol. 5, Jan. 30, 1925, p. 143 (Sosúa, Dominican Republic).

One limpkin was observed in a flooded area beyond Damien, Haiti, on May 6. At Barahona, George Hamor described one that had been killed recently near by.

Order CHARADRIIFORMES

Family CHARADRIIDAE, Plovers, Turnstones, and Surf-birds

CHARADRIUS SEMIPALMATUS Bonaparte

SEMPALMATED PLOVER

Charadrius semipalmatus BONAPARTE, Journ. Acad. Nat. Sci. Philadelphia, vol. 5, 1825, p. 98 (coast of New Jersey).

A single specimen of this plover was observed on March 26, on the shore of a point of land projecting out into the bay at Terrier Rouge, Haiti, while at Beata Island, Dominican Republic, from May 10 to 15, a few were seen daily on the glistening beds of the salt lagoons. The largest number noted in one day was eight on May 12.

PAGOLLA WILSONIA RUFINUCHA (Ridgway)

RUFIOUS-NAPED PLOVER

AEgialitis Wilsonius var. *rufinucha* RIDGWAY, Amer. Nat., vol. 8, Feb. 1874, p. 109 (Spanishtown, Jamaica).

The rufous-naped plover was observed only on Beata Island, Dominican Republic, where we found a few on the salines at the north end of the island. They probably were breeding although a rather hasty search failed to disclose a nest. One was collected on May 12.

In actions these plovers are like the parent species of the Atlantic and Gulf coasts of North America, preferring to run rather than to fly unless too closely pressed.

OXYECHUS VOCIFERUS RUBIDUS Riley

WEST INDIAN KILLDEER

Oxyechus vociferus rubidus RILEY, Proc. Biol. Soc. Washington, vol. 22, Apr. 17, 1909, p. 88 (Santo Domingo=Hispaniola).

Killdeers were seen and heard regularly in the moist lowlands of Haiti and of the Dominican Republic. Several were noted in the region between Cap-Haïtien and Terrier Rouge, March 26 to 30, and as we emerged from the mountains of the Tiburon Peninsula a short distance south of Camp Perrin on April 26 one flew ahead of us. This was the highest elevation at which the species was observed. Several were seen in the vicinity of rain-water pools in the mesquite near San Juan, Dominican Republic, on May 6, and killdeers were fairly common between that point and Azua on May 8 and 19. One was noted near L'Arcahaie, Haiti, on May 23.

SQUATAROLA SQUATAROLA CYNOSURAE Thayer and Bangs

AMERICAN BLACK-BELLIED PLOVER

Squatarola squatarola cynosurae THAYER and BANGS, Proc. New England Zool. Club, vol. 5, Apr. 9, 1914, p. 23 (Baillie Island, Arctic America).

On May 11, at Ocrik, on the north side of Beata Island, Dominican Republic, two black-bellied plovers were seen in flight over the salt lagoon.

ARENARIA INTERPRES MORINELLA (Linnaeus)

RUDDY TURNSTONE

Tringa morinella LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 249 (coast of south-eastern Georgia).

The turnstone was first noted on May 9, when two were seen near La Cienaga, about 15 kilometers south of Barahona, Dominican Republic. They proved to be fairly common around the salt pans and lagoons on Beata Island, May 10 to 15. On the latter date at least a dozen were seen, mostly in pairs.

Family SCOLOPACIDAE, Woodcock, Snipe, and Sandpipers

ACTITIS MACULARIA (Linnaeus)

SPOTTED SANDPIPER

Tringa macularia LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 249 (Pennsylvania).

We found spotted sandpipers both in the lowlands and in the mountains. Observations were made as follows: Two on April 5 at a small lagoon near Aux Cayes, Haiti; one flushed at the crossing of the Rivière des Roseaux below Bois Lacombe on April 10; several at Île à Vache on April 28 to 30; two along the bank of the Río Yaque del Sur near Boca del Baos, Dominican Republic, on May 8; and one at Barahona on May 9.

CATOPTROPHORUS SEMIPALMATUS SEMIPALMATUS (Gmelin)

EASTERN WILLET

Scolopax semipalmata GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 659 (New York).

One willet was seen at Barahona, Dominican Republic, on May 9, and we found them common and breeding on Beata Island, May 10 to 15. Three specimens and a set of four eggs were collected on May 12. The birds were observed repeatedly to perch on dead limbs at the tops of small trees, which served them as lookout posts over their nesting territory. The nest found was placed among the stems of a fleshy-leaved chenopodaceous plant growing on an open saline, and was a well-formed cup made of the dead stems of the surrounding plant built up above the level of the ground. It contained four eggs with incubation begun. A male bird was flushed from this nest, and

the other two that were collected in this breeding area were males. The eggs vary in ground color from deep olive-buff to olive-buff and are spotted boldly with more or less irregular spots of fuscous-black, bone brown, and various shades of grayish olive. They measure, in millimeters, 51.8 by 37.8, 53.5 by 38.8, 54 by 38.4, and 54.2 by 39.

TOTANUS FLAVIPES (Gmelin)

LESSER YELLOWLEGS

Scolopax flavipes GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 659 (New York).

The lesser yellowlegs was noted on March 26, when about a dozen were seen feeding on a mud flat near the flying field east of Cap-Haïtien, Haiti. One was seen near Aquin on April 5.

PISOBIA MINUTILLA (Vieillot)

LEAST SANDPIPER

Tringa minutilla VIEILLOT, Nouv. Dict. Hist. Nat., vol. 34, 1819, p. 466 (Nova Scotia to Antilles).

A single least sandpiper was seen on May 11 along the shore of the salt lagoon back of Oerik Bay, Beata Island, Dominican Republic.

PISOBIA MELANOTOS (Vieillot)

PECTORAL SANDPIPER

Tringa melanotos VIEILLOT, Nouv. Dict. Hist. Nat., vol. 34, 1819, p. 462 (Paraguay).

The pectoral sandpiper was detected once when a single bird was observed on May 10 at Beata Island, Dominican Republic. It was feeding on the mud flat of a salt pan and successfully eluded our efforts to capture it.

PISOBIA FUSCICOLLIS (Vieillot)

WHITE-RUMPED SANDPIPER

Tringa fuscicollis VIEILLOT, Nouv. Dist. Hist. Nat., vol. 34, 1819, p. 461 (Paraguay).

On Beata Island, on May 12, one white-rumped sandpiper was observed distinctly. On May 15 one was seen with a flock of semipalmated sandpipers but was wary and would not allow approach for a shot. It was observed in flight several times when its markings were easily evident through binoculars.

The species has not been recorded previously from Hispaniola, but its occurrence there is not unusual, since it has been found in migration in Puerto Rico, Jamaica, and Cuba. Specimens should be taken to support the Dominican record.

EREUNETES PUSILLUS (Linnaeus)

SEMIPALMATED SANDPIPER

Tringa pusilla LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 252 (Santo Domingo=Hispaniola).

On a large mud flat near the flying field east of Cap-Haïtien, Haiti, about 100 semipalmated sandpipers were seen on March 26. This species also was common around the shores of the salt lagoons and salt pans on Beata Island, Dominican Republic, May 10 to 15. On the latter date a large flock was evidently in migration as they appeared to have just arrived and were decidedly nervous at our approach. Three were taken on May 12.

EREUNETES MAURI Cabanis

WESTERN SANDPIPER

Ereunetes mauri CABANIS, Journ. für Orn., 1856, p. 149 (Cuba).

Ordinarily but scant reliance should be placed upon field identifications of the western sandpiper, but occasionally conditions are sufficiently favorable to allow satisfactory diagnosis without the necessity for collection. Such an opportunity was presented on March 26, when we identified several of these birds feeding in company with *E. pusillus* on a mud flat a short distance east of Cap-Haïtien, Haiti.

CROCETHIA ALBA (Pallas)

SANDERLING

Trynna alba PALLAS, in Vroeg, Cat. Rais., Adumbr., 1764, p. 7 (coast of North Sea).

The sanderling was noted on but one occasion, when a single bird was observed, May 12, at Beata Island, Dominican Republic, in company with three ruddy turnstones.

Family RECURVIROSTRIDAE, Avocets and Stilts

HIMANTOPUS MEXICANUS (Müller)

BLACK-NECKED STILT

Charadrius mexicanus MÜLLER, Natursystem, Suppl., 1776, p. 117 (Mexico).

Black-necked stilts were first observed near Cap-Haïtien, Haiti, where on March 26 five or six were feeding along the edge of the mangroves on a mud flat. At Terrier Rouge they were heard calling in the moonlit evenings of March 28 and 29. On April 29, at Île à Vache, the characteristic calls of this bird attracted our attention to an interior marsh where half a dozen individuals were seen. A few were observed on May 23, feeding on overflowed land at Source Matelas.

In the Dominican Republic we noted stilts in the harbor at Barahona on May 9, and small numbers were seen daily around the salt lagoons on Beata Island, May 10 to 15.

Family OEDICNEMIDAE, Thick-knees

OEDICNEMUS DOMINICENSIS Cory

HISPANIOLAN THICK-KNEE

Oedicnemus dominicensis CORY, Quart. Journ. Boston Zool. Soc., Oct. 1883, p. 46
(La Vega, Dominican Republic).

The Hispaniolan thick-knee was actually observed on but one occasion when a pair was found in the mesquite at Pont de l'Estère, Haiti, on March 31. They were ridiculously tame and made no attempt to fly, merely running short distances in a petulant manner as though resentful at being forced to move. One of these was collected and apparently constitutes the first specimen for Haiti, although the bird has been reported previously on a few occasions.⁴ The collection of this specimen definitely identified a local name, *coq savanne*, which was immediately used by our native guide in referring to it.

We were informed that the búcaro occurred on Beata Island, Dominican Republic, but it was not seen by us in the portions of the island visited. There are, however, open savannas of rather limited size that may be suited to its needs. Its habit of standing motionless for long periods, coupled with its highly protective coloration, may easily account for its being overlooked in many areas. Its occurrence here is, however, subject to verification.

In a recent letter Dr. R. Ciferri states that the specimen recorded by Moltoni⁵ as from San Juan, Dominican Republic, refers to a bird in captivity that was brought to San Juan from Moca, in the north. On its death it was made into a skin and through some misunderstanding San Juan was given as its proper locality. Dr. Ciferri writes that the búcaro is known properly in the south only from the great Sabana de Guerra, or Sabana de Guabatico, where both he and his brother have observed it. In the north he states that it ranges from Bonao to Dajabón along the base of the Cordillera Central in open valleys and savannas. It does not seem to pass beyond the base of the Cordillera Septentrional, being thus restricted to the great valley of the Cibao, extending from Monte Cristi to Sabana la Mar. He comments on the frequent occurrence of the bird in captivity, and of one of its peculiarities in attitude in which it frequently rests with the entire tarsus extended along the ground. The eggs, two to four in number, he says are desposited in slight hollows without nest lining. They are grayish in color, heavily dotted with small markings of brown.

Mr. and Mrs. J. E. Boog-Scott informed us that they were now certain of the occurrence of the *coq savanne* on the open gravel knolls near the experiment station at Hinche, Haiti.

⁴ See Wetmore and Swales, The birds of Haiti and the Dominican Republic. U.S.Nat.Mus.Bull. 155, 1931, p. 197.

⁵ Atti Soc. Ital. Sci. Nat., vol. 68, 1929, p. 314.

Family LARIDAE, Gulls and Terns

LARUS ATRICILLA Linnaeus

LAUGHING GULL

Larus atricilla LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 136 (Bahama Islands).

In crossing from Aux Cayes to Île à Vache on April 27, we saw five of these birds in full plumage. Between Barahona and Beata Island these gulls were common at sea, and it was noted that there was a regular flight from the south in early morning. At Beata they were common along the beach, and fished with the brown pelicans. All were in full breeding dress, so that it seems probable that there is a nesting colony somewhere in this area. One gull associated itself closely with fishing pelicans awaiting their dives to drive small fish into shallow water, whereupon it made its own plunge into the school and rarely missed its fish.

GELOCHELIDON NILOTICA ARANEA (Wilson)

GULL-BILLED TERN

Sterna aranea WILSON, Amer. Orn., vol. 8, 1814, p. 143, pl. 72, fig. 6 (Cape May, New Jersey).

Several gull-billed terns were observed on May 10 as we came in to anchor at Beata Island.

STERNA DOUGALLII DOUGALLII Montagu

ROSEATE TERN

Sterna dougallii MONTAGU, Suppl. Orn. Dict., 1813, text and plate (not numbered) (Cabrae Islands, Firth of Clyde).

At Beata Island, on May 12, we located a colony of a dozen pairs of roseate terns on a block of limestone a few feet square forming a tiny island in the lagoon back of our camp. The birds may have been present here earlier but were not definitely identified until the day mentioned. They were evidently on their breeding grounds but had not yet laid on our departure on May 15. On that day an adult male was taken. On May 16 these terns were seen in small numbers at sea between Beata and Puerto Caiman; on May 17 others were recorded north as far as Paradis.

STERNA ANAETHETA RECOGNITA (Mathews)

AMERICAN BRIDLED TERN

Melanosterna anaethetus recognita MATHEWS, The birds of Australia, vol. 2, pt. 4, Nov. 1, 1912, p. 403 (Bahama Islands).

On May 14 we found considerable colonies of bridled terns nesting on three isolated rocks lying 2 or 3 kilometers offshore from the northern coast of Beata Island, Dominican Republic. The birds

seemed to feed entirely at sea, and were not observed along shore. On May 16 and 17, individuals were observed over the open water north to a point opposite Paradis. Four specimens were taken on May 14.

On the rocks near Beata we found numerous eggs and collected a series of 11, all of them fresh. These were found in small potholes in the limestone rock, or under small projecting ledges where they were usually more or less sheltered from above. They were placed on slight accumulations of earth without other pretense to a nest. The parents were tame and flew about or rested near at hand, uttering cawing or croaking calls. Two were captured in rock crevices by hand, and others could easily have been obtained in like manner. One of those taken by this means was a male, indicating possibly that the male shares in the duties of incubation.

The eggs vary in ground color from very light pale olive-buff to a dull ivory-yellow, and are covered with small, somewhat irregular spots of bone brown and army brown, these becoming bluish slate of varying shades where overlaid by a deposit of shell. The spots are quite evenly distributed over most of the surface, though individual specimens vary in the abundance and size of the markings. They measure as follows, in millimeters: 42.8 by 33.1; 44.8 by 31.6; 45.1 by 34; 45.7 by 33.8; 46.1 by 31.7; 46.1 by 33.4; 47.6 by 32.7; 47.7 by 33.3; 47.9 by 34.4; 48 by 34.6; 48.8 by 34.5.

In previous work on West Indian birds, Wetmore has treated this tern under the name *Sterna anaetheta melanopectera* (Swainson) based on *Sterna melanopectera* of Swainson described from West Africa.

Ridgway,⁶ and more recently the fourth edition of the A.O.U. Check List of North American Birds, have accepted *recognita* of Mathews as a properly differentiated form. In view of this we follow this latter procedure without having compared birds from the eastern and western sides of the Atlantic.

STERNA FUSCATA FUSCATA Linnaeus

SOOTY TERN

Sterna fuscata LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 228 (Hispaniola).

Sooty terns were observed a short distance north of Beata Island on May 10, and others were recorded on May 16, when we were in passage north to Puerto Caïman, below Enriquillo.

STERNA ALBIFRONS ANTILLARUM (Lesson)

LEAST TERN

Sternula antillarum LESSON, Compl. Oeuvres Buffon, vol. 20, 1847, p. 256 (Guadeloupe Island, West Indies).

⁶ U.S.Nat.Mus.Bull. 50, pt. 8, 1919, p. 512.

On Beata Island, Dominican Republic, from May 10 to 15 we found this handsome tern in fair numbers about the saline lagoons and along the coast. On May 12 we located a small breeding colony nesting on the narrow ledges formed by the tops of the earth-filled dikes that divided the lagoons at the salt works into sections. We collected three sets of two eggs each, and found all to be fresh. The eggs were deposited on packed earth, and each set was surrounded by a ring of small molluscan shells. Numerous single eggs were scattered about, but in no case was the ring of shells observed about them, indicating possibly that this treatment was accorded only to complete sets. Three skins were prepared on this day.

The eggs taken vary in ground color from lighter than pale olive-buff to a warm olive-buff, spotted somewhat irregularly over the entire surface with bone brown and natal brown, these becoming various shades of bluish slate where overlaid by calcareous deposits of the shell. In some eggs the spots are fine and in others rather bold and heavy. In one egg the slaty markings predominate. Following are measurements in millimeters of the three sets obtained: 28.5 by 21.9, 28.7 by 22.2; 30.3 by 22.5, 30.8 by 22.5; 32 by 23.2, 32.8 by 23.8.

THALASSEUS MAXIMUS MAXIMUS (Boddaert)

ROYAL TERN

Sterna maxima BODDAERT, Table Planches Enl., 1783, p. 58 (Cayenne).

At Terrier Rouge, Haiti, we saw one royal tern near the Fond Blanc plantation house on March 29 and another near the entrance to Fort Liberté Bay on the same day.

This tern was recorded at Barahona on May 9, and as we came out of harbor in our tiny sloop after dark that evening a white spot on a buoy, that we passed within a few meters, in the light of a flashlight became one of these terns asleep. The birds were seen regularly the following day in passage to Beata Island, and at the latter place were seen daily along the beach. An adult male taken on May 11 was in full breeding dress. On our return on May 16 this species was recorded as far as Puerto Caïman below Enriquillo.

It is of interest to report that a royal tern banded as a chick at Egg Bank, Helena Sound, Beaufort County, S.C., on July 18, 1930, by E. Milby Burton was taken subsequently on a beach near Enriquillo, Dominican Republic, on March 13, 1931. An account of this capture published in the newspaper *La Opinion*, of Santo Domingo City, was reported to the Biological Survey in Washington by George H. Hamor, of Barahona. Another banded by Mr. Burton at Cape

Romain, S.C., July 18, 1931, was found dead November 13, 1931, on the Higuamo River, Dominican Republic.

THALASSEUS SANDVICENSIS ACUFLAVIDUS (Cabot)

CABOT'S TERN

Sterna acuflavida CABOT, Proc. Boston Soc. Nat. Hist., vol. 2, 1847, p. 257 (Tancah, Yucatan).

Several Cabot's terns were seen on May 10 at sea about 15 kilometers north of Beata Island, Dominican Republic.

ANOÛS STOLIDUS STOLIDUS (Linnaeus)

NODDY TERN

Sterna stolidus LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 137 (West Indies).

The noddy tern, known to the native fishermen as *bubi*, was common about the off-lying rocks opposite Ocrik on the north coast of Beata Island, Dominican Republic, and on May 10 came flying about our sloop in flocks when we were 15 kilometers north of the island. The birds fed entirely at sea and were not observed again, save through binoculars at a far distance, until May 14 when we visited the isolated rocks mentioned in search of sea birds. Colonies of noddies were found nesting on two of these, and two adult females and 10 sets of one egg each were collected. Two eggs were slightly incubated and the others were fresh. On May 16 noddies were noted at sea north to Puerto Caïman, below Enriquillo.

The eggs were placed on slight piles of vegetation and were scattered at random over the open surface of the rocks, in contrast to the eggs of the bridled terns that nested here also and that were placed more or less under shelter.

In ground color the 10 eggs obtained vary from dull white to very pale cartridge buff. They are spotted with brown ranging from chocolate and warm sepia to bone brown, which is changed to varying shades of bluish slaty gray where the markings are overlaid by calcareous shell material. The markings vary from fine to bold, in one or two eggs being confluent over certain areas so as to present the appearance of blotches. They are most abundant about the large end of the egg, but are scattered in varying amounts elsewhere, some eggs having few markings while in others they are abundant. Measurements, in millimeters, are as follows: 50.5 by 36.2; 51 by 35.7; 51.5 by 36; 51.8 by 34.5; 52.3 by 36.2; 53.1 by 35.2; 53.4 by 36.5; 53.9 by 36.7; 54.1 by 35.2; 56.2 by 35.6.

Order COLUMBIFORMES

Family COLUMBIDAE, Doves and Pigeons

COLUMBA LEUCOCEPHALA Linnaeus

WHITE-CROWNED PIGEON

Columba leucocephala LINNÆUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 164 (Bahama Islands).

At Deron, Haiti, on April 8, several white-crowned pigeons were killed for the table. On Île à Vache from April 28 to 30 these birds were common, being scattered through fields and pastures. On Beata Island, Dominican Republic, from May 11 to 15, this pigeon was abundant through the dry scrubs, being distributed both along the coast and in the interior. The display flight of the male is quite similar to that of the domestic pigeon, during its course the bird flying with the extended wings moving in short strokes above the level of the back. The birds were nesting on Beata.

COLUMBA SQUAMOSA Bonnaterre

SCALED PIGEON

Columba squamosa BONNATERRE, Tableau Enc. Méth., vol. 1, 1792, p. 234 (Guadeloupe Island, West Indies).

Throughout the forested areas, including the coffee plantations of the western end of the Tiburon Peninsula, this large pigeon is so abundant that it was recorded daily from April 6 to April 25 in the slow journey from Post Avancé to the La Hotte Mountains and return. On Pic de Macaya the birds ranged to the summit of the mountain and were seen daily in flight past our camp at 1,275 meters altitude. In the forests they rested in the upper branches of the trees, where, as usual, they were difficult to see among the leaves until they took flight. At Les Glaces on April 24 these pigeons were very abundant, so that in a short walk late in the afternoon among the low hills behind our camp we saw several hundred. The birds crossed the sky constantly, and dead tree tops on the horizon often had half a dozen resting in them while their cooing calls came from every side. Though there was no hunting here the birds were very wary. Several were recorded near Belladère on May 6.

COLUMBA INORNATA INORNATA Vigors

PLAIN PIGEON

Columba inornata VIGORS, Zool. Journ., vol. 3, Dec. 1827, p. 466 (near Havana, Cuba).

On May 7 we saw two plain pigeons at a waterhole in the desert area between Azua and Boca del Baos, Dominican Republic.

ZENAIIDA ZENAIIDA ZENAIIDA (Bonaparte)

ZENAIIDA DOVE

Columba zenaida BONAPARTE, Journ. Acad. Nat. Sci. Philadelphia, vol. 5, June 1825, p. 30 (Florida Keys).

This is one of the commonest doves of Haiti through areas of cultivated fields and arid scrubs, but does not penetrate into the rain forests of the better-watered areas. In the north it was recorded at Dessalines on March 25 and near Trou on March 26. Near Terrier Rouge from March 27 to 30 it was fairly common, and on March 27 at the Morne des Mammelles we flushed one from a nest that contained two fresh eggs. The nest was a broad platform of rather large twigs having a slight central depression for the eggs, placed on a level section of the inclined trunk of a twisted tree of large size, and was located 4 meters from the ground. The two eggs, white with a distinct gloss, measure 28.9 by 23 and 29.3 by 22.5 mm.

One of these doves was seen on Île à Vache on April 30.

On May 6 and 7 we found Zenaida doves common along the highway between Comendador and Azua, Dominican Republic. On Beata Island from May 10 to 15 they were common, this period being apparently the breeding season, as the display flight of the males in which they scaled through the air with set wings in great circles was seen daily. Their cooing song in tone is like that of the mourning dove but is more sonorous and is given in a monotone without the rising and falling cadences of the song of the latter species. On several occasions we saw these doves fly out from Beata Island toward the distant Dominican shore, and when collecting sea birds on isolated rocks north of Beata we observed these doves passing on several occasions, so that they appear to cross constantly between the two islands.

On May 19 and 20 in traveling from Barahona, Dominican Republic, to Port-au-Prince, Haiti, we saw Zenaida doves regularly along the highway. A few were seen near Thomazeau, Haiti, on May 22, and others near L'Arcahaie on May 23.

ZENAIIDURA MACROURA MACROURA (Linnaeus)

WEST INDIAN MOURNING DOVE

Columba macroura LINNAEUS, Syst. Nat., ed. 10, pt. 1, 1758, p. 164 (Cuba)⁷.

This species, common in cultivated sections and in many arid regions, was seen in the city of Port-au-Prince, Haiti, on March 23, and was recorded at Dessalines on March 25 and at Trou on March 26. At Terrier Rouge they were very common in the sisal fields and in adjacent areas, where they were calling constantly. At the

⁷ See Wetmore and Swales. U.S.Nat.Mus. Bull. 155, 1931, p. 171.

Morne des Mammelles on March 30 we found a nest placed on an epiphyte growing on the trunk of a tree $2\frac{1}{2}$ meters from the ground. The nest was the usual shallow structure of small twigs, and contained two eggs with incubation begun. These are white with a slight gloss and measure 26.2 by 19.7 and 25.7 by 19.4 mm.

On April 28 and 30 we recorded this dove on Île à Vache. In the region from Comendador to Barahona it was seen in some numbers along the highway on May 7 to 9, and again on May 19 and 20. On May 22 we collected five adults in open pasture land and old fields near Thomazeau, and on May 23 recorded this species at L'Arcahaie.

MELOPELIA ASIATICA ASIATICA (Linnaeus)

WHITE-WINGED DOVE

Columba asiatica LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 163 (Jamaica).

The white-winged dove was recorded as follows: Dessalines, Haiti, March 25; Trou, March 26; Terrier Rouge, March 28 and 30; Deron, April 8 (a female taken contained an egg nearly ready to be laid); Post Avancé, April 26; Île à Vache, April 28, one female taken as it flushed from a newly finished nest without eggs, and a young bird shot that was barely grown; Belladère, May 6; San Juan to Barahona, Dominican Republic, May 9 and 19; L'Arcahaie, Haiti, May 23.

Don Eduardo Echevaria said that he saw them occasionally on Beata Island, but we did not record them there.

COLUMBIGALLINA PASSERINA INSULARIS Ridgway

CUBAN GROUND-DOVE

Columbigallina passerina insularis RIDGWAY, Proc. U.S. Nat. Mus., vol. 10, 1887, p. 574 (Grand Cayman Island).

The widely distributed Cuban ground-dove was recorded at most of the lowland localities visited except that it was not observed during work on the Tiburon Peninsula. On Île à Vache it was fairly common from April 28 to 30, and a few were seen on Beata Island on May 11 and 12, three specimens being taken.

OREOPELEIA MONTANA (Linnaeus)

RUDDY QUAIL-DOVE

Columba montana LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 163 (Jamaica).

The ruddy quail-dove was recorded only on April 7 near Geffrard, Haiti, in heavy rain forest.

OREOPELEIA CHRYSIA (Bonaparte)

KEY WEST QUAIL-DOVE

Geotrygon chrysia BONAPARTE, Compt. Rend. Acad. Sci. (Paris), vol. 40, 1855, p. 100 (Florida).

On May 9, at La Cienaga, 15 kilometers south of Barahona, Dominican Republic, we flushed one of these quail-doves from a nest and collected it, the bird proving to be a male. The nest was the slight platform of twigs usual in pigeons and was placed 4 meters from the ground near the trunk of a tree which stood in a dense thicket. The nest contained one young bird, and one egg on the point of hatching. The embryo was removed so as to leave the shell intact and was skinned for a specimen. The egg is somewhat deeper than light buff in color, and measures 30.8 by 23.2 mm. The young are entirely covered with long down, pinkish buff on the upper surface and cartridge buff below.

Order PSITTACIFORMES

Family PSITTACIDAE, Parrots, Paroquets, and Macaws

AMAZONA VENTRALIS (Müller)

HISPANIOLAN PARROT

Psittacus ventralis MÜLLER, *Natursystem*, Suppl., 1776, p. 79 (Hispaniola).

Two of these parrots were seen near Dessalines, Haiti, on March 25, and others were recorded on Morne des Mammelles at Terrier Rouge, on March 27 and 30.

In riding the trails on the journey from Post Avancé into the La Hotte region we saw parrots daily; they were commonly distributed throughout this area. On Pic de Macaya they ranged to the top of the mountain, and were found in little flocks in the trees, or were noted in flight across the mountain slopes. At sunrise they came off the highest ridges, their heavy, short-winged forms showing in dark silhouettes against the distant sky.

On May 19 half a dozen were seen 50 kilometers east of San Juan, Dominican Republic, and the following day a number were observed east of Las Cahobes, Haiti.

ARATINGA CHLOROPTERA CHLOROPTERA (Souancé)

HISPANIOLAN PAROQUET

Psittacara chloroptera SOUANCÉ, *Rev. Mag. Zool.*, 1856, p. 59 ("Saint-Domingue").

Several paroquets were seen between Trouin and Jacmel, Haiti, on May 5. From Belladère to San Juan, Dominican Republic, they were common on May 7, and on May 20 a flock was recorded near Mirebalais, Haiti.

Careful watch was kept for these birds in travel in the La Hotte mountain area, their absence here being particularly noticeable since Wetmore had found them common on the ridge of La Selle in 1927. Apparently our record of this species between Trouin and Jacmel marks the western point on the Tiburon Peninsula at which it has

been reported, though there has been extensive field work in the region beyond.

Order CUCULIFORMES

Family CUCULIDAE, Cuckoos, Roadrunners, and Anis

COCCYZUS AMERICANUS AMERICANUS (Linnaeus)

YELLOW-BILLED CUCKOO

Cuculus americanus LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 111 (Carolina).

At La Cienaga, Dominican Republic, 15 kilometers south of Barahona, we saw one of these cuckoos on May 9. On Beata Island several were heard calling on May 13 from the densest growths of scrub, where they were difficult to approach. We finally collected a pair and found the female about to lay. Possibly the species had just arrived here in migration, since none had been recorded previously, and we noted others on the two following days. One was seen near Habanero on May 19, and on May 22 near Thomazeau and May 23 near L'Arcahaie, Haiti, we heard cuckoos calling that we supposed to be this species.

The two taken have the following measurements: Male, wing 134.8, tail 134.5, culmen from base 25.1, tarsus 25 mm; female, wing 141.2, tail 139.3, culmen from base 27.2, tarsus 24.5 mm.

COCCYZUS MINOR TERES Peters

MANGROVE CUCKOO

Coccyzus minor teres PETERS, Proc. New England Zool. Club, vol. 9, June 24, 1927, p. 112 (Sosúa, Dominican Republic).

On Île à Vache, Haiti, two mangrove cuckoos were seen on April 28, and a breeding male was taken. Another was observed on April 30. At Jacmel and at Gressier single birds were recorded on May 5.

SAUROTHERA LONGIROSTRIS LONGIROSTRIS (Hermann)

HISPANIOLAN LIZARD-CUCKOO

Cuculus longirostris HERMANN, Tabula affinitatum animalium, 1783, p. 186 (Hispaniola).

This common species was recorded regularly throughout the course of our work, being seen wherever there was proper cover for it. In the La Hotte region it was fairly common, ranging to 1,700 meters but not being observed beyond that point, though rain-forest conditions above were suitable for it and it may be found at the higher altitudes with more prolonged observation. Three specimens were taken here, two females and a male. The former are decidedly darker brown on the throat and darker gray on the crown than any others seen from elsewhere in Hispaniola, but in the male the throat is lighter. At

first glance it appeared that a mountain race might be indicated, but further study is required to substantiate this.

CROTOPHAGA ANI Linnaeus

ANI

Crotophaga ani LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 105 (Jamaica).

The ani was observed throughout the lowland areas that we visited, and was common at many points. At Terrier Rouge on March 28 we saw a family of five young barely able to fly, and collected one. These birds were warier than the adults and tried always to keep behind a screen of leaves. Their calls were higher pitched than those of older birds.

Anis were found in clearings in the lower elevations of the La Hotte region, but did not penetrate into the rain forests of the mountains, though we observed them in a small, open valley at Donté on April 7, and noted them also along the high ridges near Desbarriere. On Île à Vache anis were so common that flocks of them walked about in the grass in scattered companies, or gathered in gossiping groups in the shaded branches of mango trees. Half a dozen frequently rested together picking at the feathers on one another's heads. At Barahona, after a rain, anis rested in the limbs of a dead tree, their wings and tail held widely spread in the sun to allow them to dry, presenting a most grotesque appearance.

Order STRIGIFORMES

Family TYTONIDAE, Barn Owls

TYTO GLAUCOPS (Kaup)

HISPANIOLAN BARN OWL

Strix glaucops KAUP, Jardine's Contr. Orn., 1852, p. 118 (Dominican Republic).

A female shot from a tree in heavy woodland at La Cienaga, 15 kilometers south of Barahona on May 9, was our only record for this bird.

Family STRIGIDAE, Typical Owls

SPEOTYTO CUNICULARIA TROGLODYTES Wetmore and Swales

HISPANIOLAN BURROWING OWL

Speotyto cunicularia troglodytes WETMORE and SWALES, U.S. Nat. Mus. Bull. 155, Mar. 7, 1931, p. 239 (Haiti).

In Haiti the burrowing owl was seen near St. Marc on March 25 and 31, and at Source Matelas on May 23. Between Las Cahobes and Barahona, Dominican Republic, this species was fairly common on May 6 and 19. On May 12 we found two in a rough, stony area

near the sea on the northern coast of Beata Island, and collected a male. There was no soil here, but abundant holes in the limestone surface rock furnished these birds suitable shelters. The one taken does not differ from specimens from the main island.

ASIO DOMINGENSIS DOMINGENSIS (Müller)

HISPANIOLAN SHORT-EARED OWL

Strix domingensis P. L. S. MÜLLER, Vollst. Naturs. Suppl. Reg.-Band, 1776, p. 70 (Hispaniola).

Dr. R. Ciferri, under date of August 31, 1931, writes that this species is common in the Sabana San Thomé, and says that he has kept it in captivity, an individual living thus for more than a year. It builds its nest, composed of dry grasses, on the ground, and lays three white eggs, though ordinarily it rears only two young. The eggs are spherical in form.

ASIO STYGIUS NOCTIPETENS Riley

HISPANIOLAN STYGIAN OWL

Asio noctipetens RILEY, Smithsonian Misc. Coll., vol. 66, no. 15, Dec. 1, 1916, p. 1 (Constanza, Dominican Republic).

In view of the little that is known of this species it is of interest to note that Dr. R. Ciferri, under date of August 31, 1931, writes that he has kept one in captivity for a period of 6 months. He has found it rarer in occurrence than the short-eared owl, and states that in the Dominican Republic it ranges in regions of plentiful rainfall.

Order CAPRIMULGIFORMES

Family CAPRIMULGIDAE, Goatsuckers

ANTROSTOMUS CUBANENSIS EKMANI Lönnberg

HISPANIOLAN GOATSUCKER

Antrostomus ekmani LÖNNBERG, Ark. för Zool., vol. 20B, no. 6, Mar. 18, 1929, p. 1, fig. 1 (Jérémie, Haiti).

At the Morne des Mammelles, near Terrier Rouge, Haiti, on March 30 we found one of these birds lying dead beside a native hut, where it had been thrown aside after having been killed by a stick. In spite of the fact that it had been run over by an automobile and had lain for nearly a day in the hot sun, it made a presentable skin. It is the fourth specimen of this interesting bird at present known.

Though it was not possible to determine the sex of this specimen by dissection, because of its condition, it is obvious from its plumage that it is a male. The light tips of the outer tail feathers are much more extensive than in the female obtained by Dr. W. L. Abbott at Mao, Dominican Republic (U.S.N.M. No. 279260); they are white,

with only a little buff at the tips, and a wash on the under surface, instead of being entirely deep buff; and the bird is blacker with less mottling above. Curiously enough, it is the first specimen of the male sex known, as Lönnerberg's type in Stockholm, the specimen at Tring, and the one in the United States National Museum are all females. Also the bird illustrated by Rabié⁸ is a female, as indicated by the extent of the light tips on the outer rectrices and their deep-buff coloration.

The skin from Terrier Rouge has the following measurements: Wing 174, tail 144, culmen from base 16, tarsus 17.5 mm.

CHORDEILES MINOR VICINUS Riley

BAHAMAN NIGHTHAWK

Chordeiles virginianus vicinus RILEY, Auk, 1903, p. 432 (Long Island, Bahamas).

Near Las Matas, Dominican Republic, on the evening of May 6, we observed one individual. On May 19, 10 kilometers east of San Juan, following a drenching rain several were coursing over the mesquite scrub with their characteristic notes. A male taken is referable to the present race.

Order MICROPODIFORMES

Family MICROPODIDAE, Swifts

NEPHOECETES NIGER NIGER (Gmelin)

ANTILLEAN BLACK SWIFT

Hirundo nigra GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 1025 (Hispaniola).

The following records pertain to black swifts seen flying in pairs, trios, or small parties high in the air: Port-au-Prince, Haiti, March 23; Geffrard, April 7; Desbarriere, April 11; Pic de Macaya, April 15, 17, and 21; Les Glaces, April 24; Post Avancé, April 25; Belladère, May 6; Las Cahobes and Morne à Cabrits, May 20; San Juan, Dominican Republic, May 7 and 19.

STREPTOPROCNE ZONARIS PALLIDIFRONS (Hartert)

ANTILLEAN CLOUD SWIFT

Chaetura zonaris pallidifrons HARTERT, Ibis, 1896, p. 368 (Ferry River, St. Catherine, Jamaica).

On a high ridge above Donté, Haiti, a male cloud swift in breeding condition was collected on April 7, and a companion was seen. Others were observed at Bois Lacombe on April 9 and 23, and near our camp on Pic de Macaya on April 13 and 17.

⁸ Wetmore, Auk, vol. 47, 1930, pl. 47.

TACHORNIS PHOENICOBIA PHOENICOBIA Gosse

PALM SWIFT

Tachornis phoenicobia Gosse, Birds of Jamaica, 1847, p. 58 (Jamaica).

This tiny swift was observed at many localities in the lower altitudes visited, being conspicuous where it occurred because of its rapid coursing across the sky. It was first noted over the trees near the Hotel Splendide in Port-au-Prince on March 22 and 23; and was recorded regularly there until our departure at the end of May. Two were observed near our stopping place at Deron on April 8 and 9, one was recorded at Bois Lacombe on April 23, one at Les Glaces on April 24, and one at Camp Perrin on April 26. On Île à Vache a few were noted and one was taken on April 28. Inland from Jacmel, near the highway, on May 5 we found fully 60 of these birds circling with low, wheezy calls about the drooping fronds of an isolated royal palm. The birds were obviously nesting there in a colony, and six that we collected were in breeding condition. On May 7, in traveling by automobile from San Juan to Azua, Dominican Republic, we recorded a few, and on May 8 and 18 found them common at Barahona. On May 9 a number were noted at La Cienaga 15 kilometers south of Barahona, where they circled in little openings along a dry wash. Two were taken. On Beata Island on May 12 we saw one coursing over an open saline, and were greatly amused when a mango hummingbird, almost as large as the swift, darted up and pursued it for some distance with the swift circling in confusion to escape. On May 19 we observed a number in the desert area north of Habanero and wondered if they chose some other nesting site here, since there were no palms.

Family TROCHILIDAE, Hummingbirds

MELLISUGA MINIMA VIELLOTI (Shaw)

HISPANIOLAN VERVAIN HUMMINGBIRD

Trochilus Vielloti SHAW, Gen Zool., vol. 8, pt. 1, 1812, p. 347 (Hispaniola).

On the Morne des Mammelles, at Terrier Rouge, Haiti, we found a few of these hummingbirds on March 27, 28, and 30, and collected one on March 28. One was recorded at Deron on April 8, and one was seen at 1,250 meters elevation near our camp on Pic de Macaya on April 18. Another was recorded at Amiel below the high ridge at Desbarriere on April 23. On Île à Vache one was observed on April 29, and a female was taken on April 30. On the latter date a boy at our camp caught a young bird just from the nest.

RICCORDIA SWAINSONII (Lesson)

HISPANIOLAN EMERALD HUMMINGBIRD

Ornismya swainsonii LESSON, Hist. Nat. Ois.-mouches, 1829, p. 197, pl. 70 (Hispaniola).

In the areas visited, this hummingbird was recorded only in the La Hotte region, where it was common. As we entered this section at Geffrard on April 7, this hummer appeared in the rain forest, and was recorded as far as Les Glaces, and was seen also on our return on April 24. At Desbarriere one was seen on April 11, and that same day a male was taken at La Cour Z'Anglais at an elevation of only 550 meters. Others were seen at the latter locality on April 23. On Pic de Macaya we found this hummer common from April 14 to 20, and it was the only species of its family in the rain forest where it ranged in the summit of the mountain. In feeding at flowers these hummers sometimes hovered poised before the blossoms and again perched on near-by twigs while probing for food. A nest found at 1,650 meters elevation was placed 2 meters above a trail on a small twig projecting beneath an inclined tree trunk where it was protected from rain. The female was near this nest but as yet it was empty.

Two females taken on Pic de Macaya have a much deeper wash of brown on the under surface than others that we have seen.

ANTHRACOTHORAX DOMINICUS (Linnaeus)

HISPANIOLAN MANGO HUMMINGBIRD

Trochilus dominicus LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 191 (Hispaniola).

This species is the commonest hummingbird of the region, being rather universally distributed except in the dense growths of the rain forests, which it does not penetrate. At Terrier Rouge from March 26 to 30 it was noted feeding at flowers of yucca, and it was found also in the low, arid, open forest of the Morne des Mammelles. We noted that on occasion the flight was bounding, with the wings at times held stiffly spread while the bird sailed with motionless pinions for a short distance. These hummers frequently probed flowers while at rest on some perch. In the La Hotte region they were fairly common, ranging on the Pic de Macaya to the edge of the rain forest at our camp. On April 10 near Desbarriere a female darted repeatedly at us, indicating that there was a nest near by, but we could not find it. This species was seen at Camp Perrin on April 25.

On Île à Vache these hummers were fairly common from April 28 to 30, one being taken on April 29. On the day previous a female was seen at a newly finished nest 10 meters from the ground in a wild almond tree back of the beach. Near Jacmel this hummer was observed on May 5, and in crossing from Belladère, Haiti, to Barahona, Dominican Republic, on May 6 and 7, we found it fairly common.

On Beata Island this species was fairly common from May 11 to 15, and several specimens were taken. These do not differ from skins from the main island opposite, which was to be expected, as the distance of separation is not great, and hummers should cross the strait readily. One was seen pursuing a palm swift as already noted.

A nest found on May 13 was placed on a horizontal limb in a shrub 2 meters from the ground at the edge of brush bordering a saline. The nest is composed of cottony plant fibers forming a deep cup, covered externally with thin flakes of bark bound on with spiders' web. It measures approximately 40 mm in diameter by 32 mm high, and rests on a flat crotch where it has firm support. The two white eggs were heavily incubated, so that only one is available for measurement, its dimensions being 14.5 by 9.5 mm.

Other hummers of this species were seen at Habanero, Dominican Republic, May 19; at Las Cahobes, Haiti, May 20; and near L'Arcahaie, May 23.

Order TROGONIFORMES

Family TROGONIDAE, Trogons

TEMNOTROGON ROSEIGASTER (Vieillot)

HISPANIOLAN TROGON

Trogon roseigaster VIEILLOT, Nouv. Dict. d'Hist. Nat., vol. 8, 1817, p. 314 (Hispaniola).

In the La Hotte region the trogon was one of the common forest birds recorded daily in our travels through this area. On April 6, as our pack train started up the winding trail beyond Post Avancé, the calls of the trogon came to us from the forested slopes above us, and as we left the region by the same trail on our way out on April 25, and as we came down into the coffee plantations toward Camp Perrin, the same notes faded out in the distance behind. A female taken at Donté on April 7 was nearly ready to lay. On the Pic de Macaya, trogons were common, ranging to the summit of the mountain, being especially numerous among the great pines of the higher altitudes. Two males taken there were not in breeding condition so that the nesting period seems to vary locally. At our camp their curious calls came to us all through the day as one of the regular bird songs of the forest, and the trogons themselves came daily in trees about our tent.

Order CORACIIFORMES

Family ALCEDINIDAE, Kingfishers

MEGACERYLE ALCYON ALCYON (Linnaeus)

BELTED KINGFISHER

Alcedo alcyon LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 115 (North America).

On March 25 we noted a kingfisher on the Limbé River, near Limbé, Haiti, and the following day observed one at the border of a lagoon near Cap-Haïtien. One was seen on April 12 at the inland locality of La Cour Z'Anglais on the Anglais River at an elevation of 600 meters

above the sea. On Beata Island from May 10 to 12 one fished daily in the little bay in front of our quarters at Ocrik. We were amused on one occasion to see the bird, intent on its meal, dive at a school of fish at the same time as a pelican, only to veer off in sudden alarm as in his descent he nearly struck his large competitor. The date of May 12 is the latest recorded in spring in this area for this species, and as the bird then disappeared we assumed that it had moved northward in its migration.

Family TODIDAE, Todies

TODUS SUBULATUS Gray

HISPANIOLAN TODY

Todus subulatus GRAY, Gen. Birds, vol. 1, Apr. 1847, pl. 22 (Hispaniola).

This widely distributed species was observed in most of the lowland localities visited on the main island. A breeding male tody was taken at Trou, Haiti, on the north plain on March 26. In the region of Terrier Rouge it was common from March 27 to 30, and at that time was nesting. We were interested to note its distribution in small numbers along steep-banked drainage ditches running through the sisal fields as an indication of adaptation to a change in environment brought about by cultivation.

In entering the La Hotte region we found this species as far as Camp Perrin on April 6, and on our return on April 26 observed it again near that point and from there on down to the coast at Aux Cayes. As we were crossing from Port-au-Prince, Haiti, to Barahona, Dominican Republic, on May 6 and 7, it was distributed along our road, and on May 19 on our return we collected two in the desert area north of Habanero. These are quite light on the breast, the difference being due apparently to wear in the plumage.

TODUS ANGSTIROSTRIS Lafresnaye

NARROW-BILLED TODY

Todus angustirostris LAFRESNAYE, Rev. et Mag. Zool., Oct. 1851, p. 478 (Dominican Republic).

As we entered the heavily watered La Hotte region this tody appeared above Post Avancé, and was recorded throughout our work in the mountain section, where it entirely replaced the other species. There was no mingling of the two in the interior so far as we observed, as the present species was found even to the low altitude of La Cour Z'Anglais at 600 meters elevation. On the Pic de Macaya the narrow-billed tody was one of the common forest birds, ranging to the summit of the mountain. Its rattling notes were heard regularly, but many times we were not able to locate the tiny birds in the dense growths of vegetation. While the narrow-billed tody, like its cousin, captures insects regularly on the wing, it also hops about among the

leaves and small branches, seeming more active in this way than its relative. Both sexes utter the chattering call. Several specimens taken are in excellent plumage.

Order PICIFORMES

Family PICIDAE, Woodpeckers

CHRYSERPES STRIATUS (Müller)

HISPANIOLAN WOODPECKER

Picus striatus P. L. S. MÜLLER, Vollst. Naturs., Suppl. Reg.-Band, 1776, p. 91 (Hispaniola).

The woodpecker is one of the widely distributed and common native birds that we observed in all the regions visited on the main island, but that was not found on Île à Vache or on Beata. At Terrier Rouge, from March 27 to 30, these birds were surprisingly abundant around the Morne des Mammelles, and we were astonished to find a dozen pairs going in and out of nesting holes in a single dead tree trunk standing in an open space, the holes being 3 to 10 meters from the ground and in some cases less than a meter apart. There was no question that the woodpeckers were colonizing, as the trunk was a veritable apartment house with the birds clambering actively over its surface and flying back and forth to the near-by woodland.

In the La Hotte region in April these woodpeckers were abundant, being found both in native forest and in the coffee plantations. On Pic de Macaya they ranged to the summit of the mountain, and were found in the plantations about its base wherever there were trees. The woodpecker was one of the few species of birds that were found in any abundance on the higher ridges, and its laughing calls were heard regularly in traversing the rain forest.

The species was noted regularly along the road on our journey from Port-au-Prince to Barahona, Dominican Republic, and was seen in fair numbers in the desert sections.

Curiously enough, Wetmore during two extended periods of observation (in 1927 and 1931) did not hear this woodpecker drum as is customary among its many relatives, though during the present excursion especial attention was paid to this matter. Apparently it may not have this habit.

NESOCITITES MICROMEGAS (Sundevall)

HISPANIOLAN PICULET

Picumnus micromegas SUNDEVALL, Conspectus avium picinarum, 1866, p. 95 (Hispaniola).

On March 28 we had a glimpse of two piculets in the low scrub covering the Morne des Mammelles near Terrier Rouge, and on March 30 a male was taken by S. W. Parish.

Order PASSERIFORMES

Family TYRANNIDAE, Tyrant Flycatchers

TYRANNUS DOMINICENSIS DOMINICENSIS (Gmelin)

GRAY KINGBIRD

Lanius dominicensis GMELIN, Syst. Nat., 1788, vol. 1, pt. 1, p. 302 (Hispaniola).

The gray kingbird is found commonly both in Haiti and the Dominican Republic at the lower elevations, chiefly in the cultivated areas. In the La Hotte Mountains on the Tiburon Peninsula it became noticeably scarcer after we left Poste Avancé on April 6. A few were observed along the trail near Bois Lacombe, on April 9. One was heard in the vicinity of our camp on Pic de Macaya, at 1,275 meters, on April 16, and another was seen at Bois Pin Lacadonis on April 24, but it is comparatively rare in this forested section.

On Île à Vache, April 27 to 30, the gray kingbird was recorded as one of the commonest birds.

A few were seen and one was collected on Beata Island, Dominican Republic, May 10 to 15.

During the latter part of May, kingbirds were generally seen in pairs, indicating that mating was in progress.

TOLMARCHUS GABBII (Lawrence)

HISPANIOLAN PETCHARY

Pitangus Gabbii LAWRENCE, Ann. Lyc. Nat. Hist. New York, vol. 11, 1876, p. 288 (Hato Viejo, Mao River, Province of Santiago, Dominican Republic).

The petchary was recorded first at Terrier Rouge, Haiti, where one was seen in a recently cut over area on March 27. At Deron, on April 8, several were noted and two collected. The sexual organs were active, and breeding was further confirmed by observations of other individuals that were carrying nesting material.

On April 9, when we were a short distance from Deron, we noted two feeding around a native beehive, but it was not determined whether they were catching workers or drones. In this same region an interesting albinistic female was collected on April 24. The crown patch was normal but the balance of the plumage was a mixture of white and light brown. This species was noted up to the upper limits of the coffee plantations, although only one was recorded at our camp on Pic de Macaya at 1,275 meters, a bird seen on April 17.

In the Dominican Republic the species was detected on May 9, near Barahona, and on May 19, when a single specimen was observed as we emerged from the desert onto the main highway, 15 kilometers northeast of Azua.

MYIARCHUS DOMINICENSIS (Bryant)

HISPANIOLAN FLYCATCHER

Tyrannula stolidus (var. *dominicensis*) BRYANT, Proc. Boston Soc. Nat. Hist., vol. 11, May 1867, p. 90 (Port-au-Prince, Haiti).

This flycatcher was observed commonly in the lowlands of both countries. In Haiti it was recorded as follows: Dessalines, March 25; Trou, March 26, one collected and others seen; Terrier Rouge, March 27, common on Morne des Mammelles, one taken; Aux Cayes, April 6 and 26; Île à Vache, April 27 to 30, common, several taken; Thomazeau, May 22, common in the Cul-de-Sac plain; and L'Arcahaie, May 23, one taken and others seen or heard. None were observed in the La Hotte region.

In the Dominican Republic this flycatcher was particularly numerous in the desert region between Azua and Boca del Baos, May 19. One was taken at La Cienaga south of Barahona, May 9, and another on Beata Island, May 11. This last was the only one noted on Beata although the habitat would seem to be suited to its needs.

BLACICUS HISPANIOLENSIS HISPANIOLENSIS (Bryant)

HISPANIOLAN WOOD PEWEE

Tyrannula caribaea (var. *hispaniolensis*) BRYANT, Proc. Boston Soc. Nat. Hist., vol. 11, May 1867, p. 91 (Port-au-Prince, Haiti).

At Terrier Rouge, Haiti, from March 27 to 30, this species was fairly common, particularly around the base of Morne des Mammelles, where three specimens were taken. It was recorded at Geffrard, on April 7, and at our camp on Pic de Macaya, from April 12 to 21, one or two were seen every day, the birds ranging through the forest to the top of the mountain. In the clearings near camp they perched in low bushes, while in the great pines of the higher altitudes they frequently rested on the highest of dead limbs, at times beyond gunshot.

On April 23, while at Amiel, below Desbarriere, we observed one that was extraordinarily fearless as it repeatedly captured insects within 3 or 4 feet of us. One was taken on May 19 about 4 miles north of Habanero, Dominican Republic, and a few others were seen along the road between that point and San Juan. The species is thus one that can accommodate its life to arid or humid regions at need.

ELAENEA ALBICAPILLA (Vieillot)

HISPANIOLAN ELAENIA

Muscicapa albicapilla VIEILLOT, Hist. Nat. Ois. Amér. Sept., vol. 1, 1807, p. 66, pl. 37 ("Saint-Domingue" = Hispaniola.)

We found the elaenia only in the La Hotte Mountains of western Haiti. It was first obtained on April 17 on Pic de Macaya at an altitude of about 1,700 meters. On April 30 two more were obtained a few hundred feet lower, and still others were seen or heard. All

these specimens were taken from the larger forest shrubs beneath pines, where the birds worked actively about, uttering their twittering calls and trilling songs. There was much about them and their habitat to suggest the alder flycatcher.

On April 23 on an open ridge at Amiel, below Desbarriere, while we were waiting for two straggling porters to catch up with the main outfit, a pair of *elaenias* suddenly appeared in a low tree within a few feet of us. Hurriedly dismounting we were able to obtain them both. The altitude at this point was about 1,000 meters.

Comparison of the birds from the La Hotte region with specimens from other points in the island reveals no characters of difference.

Family HIRUNDINIDAE, Swallows

LAMPROCHELIDON SCLATERI (Cory)

SCLATER'S SWALLOW

Hirundo sclateri CORY, Auk, 1884, p. 2 (La Vega, Dominican Republic).

At Kenskoff, Haiti, on March 22, we observed half a dozen of these swallows circling about the eaves of a small building, where they seemed to be nesting in crevices under the roof tiles. Elsewhere we found the species only in the mountains of La Hotte. At Geffrard on April 7 a pair came about the native hut where we had spent the night, seeming to have a nest in the roof thatch. On April 9, at Bois Lacombe, 15 or 20 individuals were found circling over an open slope. One taken there was a female about to breed. Near Desbarriere a few were observed on April 10 and 11. On the Pic de Macaya this swallow was common, ranging from the open cultivated valleys at the base to the forested summit of the mountain. On the higher slopes they were found around the great pines that towered far above the surrounding rain forest, and often when working through the dimly lighted, dripping verdure of the dense growth we heard the soft voices of these swallows as the birds coursed over the tops of the trees above us. At this season they were nesting. We collected a series of eight, all in full plumage.

HIRUNDO ERYTHROGASTER Boddaert

BARN SWALLOW

Hirundo erythrogaster BODDAERT, Table Planches Enl., 1783, p. 45 (Cayenne).

Single barn swallows, migrant from North America, were seen on Île à Vache, Haiti, April 28 and 29. On Beata Island, Dominican Republic, four were observed on May 11, and two in company on May 12, 14, and 15, the last date being that of our departure. These constitute the latest dates of occurrence known for this region.

PETROCHELIDON FULVA FULVA (Vieillot)

HISPANIOLAN CLIFF SWALLOW

Hirundo fulva VIEILLOT, Hist. Nat. Ois. Amér. Sept., vol. 1, 1807, p. 62, pl. 32 (Hispaniola).

Near Cap-Haïtien, Haiti, on March 26, we saw a dozen flying about a culvert, not more than half a meter high, in which they were obviously searching for a nesting site. At Terrier Rouge a few were observed over the sisal fields on March 27, and on March 30 we found a number about an old French ruin standing in the open. On Île à Vache on April 28 we recorded a dozen circling over cliffs above the sea and collected two. A few were seen the day following. Several were observed near Barahona, Dominican Republic, on May 7.

PROGNE DOMINICENSIS (Gmelin)

CARIBBEAN MARTIN

Hirundo dominicensis GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 1025 (Hispaniola).

In view of our extensive travel the scarcity of the martin is worthy of comment, as we recorded them only at Aux Cayes on April 26 and 27 and on Île à Vache on April 28.

Family CORVIDAE, Jays, Magpies, and Crows

CORVUS LEUCOGNAPHALUS Daudin

WHITE-NECKED CROW

Corvus leucognaphalus DAUDIN, Traité d'Ornithologie, vol. 2, 1800, p. 231 (Porto Rico).

Between Port-au-Prince and Cap-Haïtien, Haiti, on March 25, we saw these crows regularly along the auto road, and on March 31 recorded several at Pont de l'Estère. On May 6 and 7 we found them distributed in small numbers from Las Cahobes, Haiti, to near Azua, Dominican Republic. We observed them again at Las Cahobes on May 20, and near Source Matelas on May 23. This is one of the species that will become rarer with increased cultivation of the land.

CORVUS PALMARUM PALMARUM Württemberg

PALM CROW

Corvus palmarum WÜRTEMBERG, Erst. Reis. Nördl. Amer., 1835, p. 68 (Cibao Mountains, Dominican Republic).

The palm crow was found near Dessalines, Haiti, on March 25, and along the highway between Las Cahobes and San Juan on May 6 it was fairly common. On May 20, while we were collecting small birds in the open country east of Las Cahobes, several of these crows came about scolding us raucously, telling in no uncertain terms what they thought of us and our activities. A few were seen near Thomazeau on May 22, and near Source Matelas on May 23.

Family MIMIDAE, Mockingbirds and Thrashers

MIMUS POLYGLOTTOS DOMINICUS (Linnaeus)

HISPANIOLAN MOCKINGBIRD

Turdus dominicus LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 295 (Hispaniola).

The mocker was recorded universally during our travels and work in the lowlands, and was one of the species regularly observed along the highways. At Trou, Haiti, on March 26, one was observed feeding a fully grown young bird. At Terrier Rouge this species was common from March 27 to 30. On April 6 the mocker was found from Aux Cayes to Camp Perrin, and on April 26 was observed in the same area. None were seen in the La Hotte area, though it is probable that with increased clearing for cultivation the mockingbird will gradually extend into the lowlands of this area. On Île à Vache, from April 28 to 30, the mocker was the most conspicuous, if not indeed the most abundant, passerine bird. Two males and one female were collected there. At Jaemel we found this bird common on May 5.

Through the desert region between Azua and Barahona, Dominican Republic, the mocker was the most abundant bird, and it was observed commonly in the open country about Barahona itself. It seemed to us that birds in the desert region showed more white in the wing and tail than those observed elsewhere, but four that we collected near Habanero on May 19 do not differ appreciably from birds from more humid sections. At Thomazeau, Haiti, on May 22 we observed one mocker with the entire tail pure white. On May 23 we found these birds abundant near L'Arcahaie.

Though mockers were singing constantly, it was only occasionally that we heard one imitating the songs of other birds. At Terrier Rouge we observed one that imitated the songs of the Jamaican vireo, flat-billed vireo, and Hispaniolan thrush. On Île à Vache mockers gave the song of the Jamaican vireo regularly, and near Barahona we heard one gifted individual that included the notes of the gray kingbird, tody, vireo, and woodpecker in its repertoire.

DUMETELLA CAROLINENSIS (Linnaeus)

CATBIRD

Muscicapa carolinensis LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 328 (Virginia or Carolina).

Near Terrier Rouge on May 28 a catbird was seen distinctly at close range by Lincoln and by S. W. Parish. This is the second record for Hispaniola, one having been taken by Dr. W. L. Abbott on Tortue Island on February 5, 1917.⁹

⁹ See Wetmore and Swales, U.S.Nat.Mus.Bull. 155, 1931, p. 333.

MARGAROPS FUSCATUS FUSCATUS (Vieillot)

PEARLY-EYED THRASHER

Turdus fuscatus VIEILLOT, Hist. Nat. Ois. Amér. Sept., vol. 2, 1807, p. 1, pl. 57 bis (Hispaniola: Puerto Rico).

This bird was found in fair numbers in the dry scrubs of Beata Island, where four were taken on May 11, 13, and 15. The broken song, not heard by Wetmore for 20 years, was clear in memory as it came on our first excursion into the thorny thickets, and its identity was verified by the first specimen that came to hand. The birds were secretive and were approached with some difficulty as they rested under cover in the tops of the low trees.

This record establishes the present form as one properly included in the list of Hispaniolan birds, as previously it has been known only from an uncertain statement by Vieillot, who in 1807 said that he found it in Haiti, and from a living specimen purchased by Beebe in a collection of live birds secured for the New York Zoological Society in Haiti. The suggestion of Wetmore and Swales¹⁰ that the species might occur on some of the smaller islets has now been verified. Possibly the living bird purchased by Beebe in Port-au-Prince came from Beata, since Haitian fishermen until recently visited the island in their fishing expeditions.

The specimens obtained are of the typical race.

Family TURDIDAE, Thrushes, Bluebirds, and Solitaires

MIMOCICHLA ARDOSIACEA ARDOSIACEA (Vieillot)

HISPANIOLAN THRUSH

Turdus ardosiacus VIEILLOT, Tableau Enc. Méth., vol. 2, 1823, p. 646 (Hispaniola).

Near Terrier Rouge, Haiti, this robinlike thrush was found in small numbers in the scrub covering the Morne des Mammelles. Throughout the La Hotte region it was common, being observed from April 6 to 26, appearing at Camp Perrin and continuing throughout our travels in this region until we came down once more toward Aux Cayes. It was particularly common through the coffee plantations of the area between Deron and Bois Lacombe, and on the slopes of Macaya above La Cour Z'Anglais, being in fact the most abundant bird of these areas. On the Pic de Macaya it was common, ranging from groves in the cultivated areas near the base to the forests clothing the summit of the peak. The broken songs of this thrush awakened us each morning at daybreak, and in work in the forests its loud calls came instantly at any disturbance, though the birds themselves were shy and usually kept under cover. At times, however, they flew up

¹⁰ *Ibid.*, p. 331.

to perch near at hand with a flirt of wings and tail, but at any movement disappeared instantly into the nearest cover. In the high forest they were found in growths of bracken that formed dense cover over the ground. The natives here called them *cuet cuet* in imitation of their call notes. Four were taken in this region.

These birds were seen in small numbers between San Juan and Azua, Dominican Republic, on May 7 and 19, and near L'Arcahaie, Haiti, on May 23.

MYADESTES GENIBARBIS MONTANUS CORY

HISPANIOLAN SOLITAIRE

Myadestes montanus CORY, Bull. Nuttall Orn. Club, 1881, p. 130 (near Fort Jacques, above Pétionville, Haiti).

In the rain forest covering the Pic de Macaya we found the solitaire to be one of the common birds, ranging to the summit of the mountain. Males were in full song from April 13 to 20, and their clear notes came to us constantly through the day, constituting one of the most wonderful bird songs that we have heard. The bird is always a skilled musician, certain of his powers, uttering his flutelike notes with a clear precision that is as pleasing as the beautiful tones that they carry to the ear. There is some variation in sound and expression, but all possess an unmistakable imprint and are identified as those of a solitaire without hesitation. We never tired of the constant repetition of this marvelous song from the hidden avian choir, and it constitutes one of our most vivid memories in connection with the dark, rain-drenched forests of this difficult mountain peak.

In a series of ten that we collected, all in breeding condition, there is only one female, males seemingly being much more curious and aggressive.

Family DULIDAE, Palm-chats

DULUS DOMINICUS DOMINICUS (Linnaeus)

PALM-CHAT

Tanagra dominica LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 316 (Hispaniola).

In the suburban gardens of Port-au-Prince, Haiti, the palm-chat was as common in March and April of 1931 as Wetmore had found it in 1927. At Terrier Rouge we observed a few in the low forest of the Morne des Mammelles, where a breeding male was taken on March 27. We found them at Aux Cayes on April 6, and on April 8 and 9 observed colonies near Deron. On April 23 we saw one nest in a tall deciduous tree on the ridge near Amiel, below Desbarriere, and saw others the following day near Les Glaces. From Trouin to Jacmel on May 5 the birds were found in some numbers, and near Belladère on

May 6 they were very common. They were found near San Juan, Dominican Republic, on May 7 and 19; near Las Cahobes, Haiti, one was taken and many seen on May 20; and we found them at Thomazeau on May 22, and at L'Arcahaie on May 23.

Family VIREONIDAE, Vireos

VIREO OLIVACEUS OLIVACEUS (Linnaeus)

JAMAICAN VIREO

Muscicapa olivacea LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 327 (Jamaica).

This vireo is one of the most widely distributed woodland birds of the region here considered. In the north of Haiti we found it at Dessalines, March 25; near Trou, March 26; and near Terrier Rouge, March 27 to 30. Birds collected were near breeding season. In the La Hotte region these vireos were common, and after leaving Aux Cayes we noted them regularly all along the mountain trails, though on the Pic de Macaya they were restricted to the lower slopes and did not enter the dense rain forest, not being found on this mountain above 1,300 meters altitude. At La Cour Z'Anglais they were especially common, and we were awakened at dawn on April 23 by a loud chorus of song from these birds on the adjacent mountain slopes. On Île à Vache this vireo was common from April 28 to 30, and near Jaemel we found it on May 5. It was noted regularly from the highway in crossing from Port-au-Prince to near Azua, Dominican Republic, on May 6 and 7, and on May 9, 10, and 18 it was found near Barahona. A few were noted on Beata Island. It was recorded near L'Arcahaie, Haiti, on May 23.

LAWRENCIA NANA (La wre nce)

FLAT-BILLED VIREO

Empidonax nanus LAWRENCE, Ibis, 1875, p. 386 (Dominican Republic).

On the low elevation of the Morne des Mammelles, near Terrier Rouge, Haiti, on March 27, attention was attracted by a trilling song that Wetmore had heard at Sánchez in 1927, and, on following it up, in a few minutes he had in hand a specimen of the rare flat-billed vireo, which verified the supposition of 4 years earlier that the song in question must be that of this species. We found the bird fairly common in the semiarid forest there, and in all we obtained nine specimens, taken on March 27 and 30. They ranged in low, dense forest where they moved about slowly, seldom far from the ground and occasionally on it, hopping or fluttering from perch to perch, in appearance and habit strongly suggestive of Bell's vireo. After each move they rested quietly, turning the head slowly about to

examine near-by leaves critically, and then continuing to another location. As they are small and inconspicuously colored they are thus difficult to see in the dense growths that they inhabit, and it was only by following up their songs, and standing quietly for several minutes to watch, that we could locate them. Their flight was undulating.

The song has a distinct resemblance to the trill of a pine warbler. One that was observed near at hand for several minutes sang with wings drooped, occasionally throwing the tail above the level of the back. Their call note resembled the syllable *zhree* uttered in a very low tone, a distinctly vireonine call. Specimens taken were in breeding condition.

From present information it appears that this species inhabits low forests growing over limestone hills.

Both sexes have pale, straw-yellow eyes.

One of the specimens taken, collected by S. W. Parish, is a juvenile female in molt in first fall plumage, a few light brownish-olive feathers remaining on the crown and hind neck to indicate the color of the juvenal dress. Wetmore¹¹ has remarked that there seemed to be two color phases in this species, one in which the under surface is yellow and one in which it is white. From examination of this young bird it develops that the supposed white phase is in reality the first fall plumage, as the young bird has the feathers of the under surface largely white. The type specimen taken years ago by Gabb in the Dominican Republic is white below and is therefore an immature bird in first fall dress. The remaining skins in our series from Terrier Rouge are all strongly suffused with yellow below.

Family COEREBIDAE, Honey-creepers

COEREBIA BANANIVORA BANANIVORA (Gmelin)

HISPANIOLAN HONEY-CREEPER

Motacilla bananivora GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 951 (Hispaniola).

Near Trou, Haiti, we found this bird on March 26, and at Terrier Rouge encountered it on March 27 and 28. In the La Hotte region in April it was common in forested areas, and was one of the few small birds that ranged in the wet forests of the Pic de Macaya to the summit of the mountain. On Île à Vache it was very common from April 28 to 30, and it seemed to us that the song was louder and more emphatic than that of the honey-creepers we had seen during the previous week around La Hotte. Specimens taken, however, in good series, do not seem to differ from those from the main island. One young bird, fully grown but in juvenile dress, was

¹¹ U.S.Nat.Mus.Bull. 155, 1931, p. 358.

collected here, and we saw several adults that were nest building. On April 30 we collected one fresh egg from a nest in a bush only two thirds of a meter from the ground. The nest was the usual ball-shaped structure with the entrance beneath. The egg is dull white, marked with finely stippled spots of natal brown that merge to form a band around the egg slightly above its center. This egg measures 17.7 by 12.2 mm.

Near La Cienaga, 15 kilometers south of Barahona, the honey-creeper was common May 9, and from May 11 to 15 we found it in numbers on Beata Island and collected a series. Several were found in the desert area north of Habanero on May 19.

Family COMPSOTHTYPIDAE, Wood Warblers

MNIOTHTA VARIA (Linnaeus)

BLACK AND WHITE WARBLER

Motacilla varia LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 333 (Hispaniola).

The black and white warbler was observed on two occasions. On March 25, while near Dessalines, Haiti, we saw at least one and probably two individuals, and on March 28, at Terrier Rouge, noted several along a dry wash.

COMPSOTHTYPIDIS AMERICANA PUSILLA (Wilson)

NORTHERN PARULA WARBLER

Sylvia pusilla WILSON, Amer. Orn., vol. 4, 1811, p. 71, pl. 23, fig. 3 (eastern Pennsylvania).

On April 4, at Port-au-Prince, Haiti, a single parula warbler was observed in a large flamboyant tree in the yard at our hotel. It was in company with several other warblers, chiefly *Dendroica discolor*.

DENDROICA PETECHIA ALBICOLLIS (Gmelin)

HISPANIOLAN GOLDEN WARBLER

Motacilla albicollis GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 983 ("S. Dominici" = Hispaniola).

The golden warbler was recorded on Île à Vache, Haiti, where on April 29 we had brief glimpses of two or three birds in a small mangrove swamp at the head of one of the bays. A pair was located on May 23 in mangroves near L'Arcahaie, but attempt to obtain a specimen was unsuccessful.

On May 8 and 18, at Barahona, Dominican Republic, several were seen on a small mangrove island near the sugar factory. In every case the birds proved extremely elusive and difficult to locate. Their characteristic song is given chiefly early in the morning and to a lesser extent late in the afternoon.

DENDROICA TIGRINA (Gmelin)

CAPE MAY WARBLER

Motacilla tigrina GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 985 (Canada).

The Cape May warbler was common as usual at suitable localities in Haiti. On March 27 one was taken at Terrier Rouge by S. W. Parish, and on the following day we found them common and collected two in a dry arroyo through the mesquite. They were next observed on April 10, on the crest of the ridge (altitude 1,100 meters) at Desbarriere, where 30 or 40 were noted and two collected. One was seen on April 12 at La Cour Z'Anglais.

Our greatest surprise, however, was to find these warblers plentiful and in full song on Île à Vache from April 27 to 30, where we collected several specimens. They were particularly numerous in the wild almond trees that fringed the beach at Feret Bay. It was a matter for repeated comment that on this little Caribbean island we heard the song of this North American species many times each day, while in years of observation in the vicinity of Washington, D.C., we had heard it only on two or three occasions, and then in weak and lisping form quite different from the finished song of the Île à Vache birds. The music of these handsome warblers heard constantly at our camp was in fact one of the features of our work on this island. The night of April 27 offered perfect conditions for migration, and on the following morning there was a noticeable reduction in numbers among these birds.

W. B. Alexander has brought to Wetmore's attention a record for this species overlooked in previous work. This is found in Edwards's, Gleanings of Natural History, vol. 5, 1758, pl. 257, where a Cape May warbler is shown in color from a specimen "taken Novem^r 1st on the Coast of Hispaniola, about ten Leagues from Land by Tho^s Stack M. S. & F. R. S. in a Voyage from London to Jamaica."

DENDROICA CAERULESCENS CAERULESCENS (Gmelin)

BLACK-THROATED BLUE WARBLER

Motacilla caerulescens GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 960 ("S. Dominici" = Hispaniola).

Black-throated blue warblers were noted regularly in Haiti from March 30 to May 6. A fine male was seen on March 30 on Morne des Mammelles, near Terrier Rouge; on April 9 one was observed near the crest of the pine ridge known as Bois Pin Lacadonis a short distance east of Bois Lacombe; three or four of both sexes were seen on April 12 at La Cour Z'Anglais; from April 14 to 20 they were noted almost daily on the slopes of Pic de Macaya from 900 meters up at least as high as 2,100 meters and probably ranged across the summit of the mountain; a few were seen at Bois Lacombe on April 24 and a few near

Camp Perrin on April 26; while the last individual, a male, was noted May 6, on the slopes of Morne à Cabrits.

Curiously, most of those seen in the La Hotte region were females. On April 20 we recorded the fact that while several females were observed that day, we had not detected a male at any point on Pic de Macaya.

DENDROICA DOMINICA DOMINICA (Linnaeus)

YELLOW-THROATED WARBLER

Motacilla dominica Linnaeus, Syst. Nat., ed. 12, vol. 1, 1766, p. 334 (Hispaniola).

On March 23, in Port-au-Prince, Haiti, a small flock of warblers was observed in the trees about the Hotel Splendide, among them at least one yellow-throated warbler, which was singing, and it is probable that there were others present. One was seen in Port-au-Prince on April 4. Individuals also were seen or heard near Dessalines on March 25, and on Île à Vache on April 29.

DENDROICA PALMARUM PALMARUM (Gmelin)

PALM WARBLER

Motacilla palmarum Gmelin, Syst. Nat., vol. 1, pt. 2, 1789, p. 951 ("S. Dominici" = Republic of Haiti).

The palm warbler was detected at Trou, Haiti, on March 26, and at Terrier Rouge, where two were seen on March 28.

DENDROICA DISCOLOR DISCOLOR (Vieillot)

NORTHERN PRAIRIE WARBLER

Sylvia discolor VIEILLOT, Hist. Nat. Ois. Amér. Sept., vol. 2, 1807 (1809?), p. 37, pl. 98 (Eastern United States or Greater Antilles).

In Port-au-Prince, Haiti, March 23 and 24, prairie warblers were fairly common, and their characteristic, ventriloquial song was heard frequently. They were still present there on April 4.

One was collected at Trou on March 26, and we found them plentiful in the mesquite at Terrier Rouge on March 28. At that point they were evidently gathering for migration, and the specimens taken were excessively fat. They were heard singing there also. Part of those examined were undergoing a molt of the feathers of the throat.

DENDROICA STRIATA (J. R. Forster)

BLACK-POLL WARBLER

Muscicapa striata J. R. FORSTER, Phil. Trans., vol. 62, 1772, pp. 406, 428 (Fort Severn, west coast of Hudson Bay).

The black-poll warbler was detected only on Île à Vache, Haiti, where several were seen and heard singing April 27 and 28 in the wild almonds under which our camp was pitched.

SEIURUS AUROCAPILLUS AUROCAPILLUS (Linnaeus)

OVENBIRD

Motacilla aurocapillus LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 334 (at sea about 30 miles from Hispaniola).

The ovenbird was recorded in Haiti on the following occasions: At least one and probably two were seen at Terrier Rouge on March 28; one was taken on April 16 in the rain forest on Pic de Macaya at an altitude of about 1,500 meters; on April 24, while we were eating breakfast at Bois Lacombe, one sang its well-known "teacher" song close by our camp; and on April 30 one was observed on a wooded hillside on Île à Vache.

SEIURUS NOVEBORACENSIS NOTABILIS Ridgway

GRINNELL'S WATER-THRUSH

Seiurus naevius notabilis RIDGWAY, Proc. U.S. Nat. Mus., vol. 3, 1880, p. 12 (shores of Como Lake, Carbon County, Wyoming).

Though no water-thrushes were seen during our work, in view of the little known of this race for Hispaniola it is pertinent to record here certain observations. In June 1930, through the kindness of Lord Rothschild, Wetmore examined the series of water-thrushes from the Dominican Republic in the collection of the Tring Museum, and among them identified two as of the race *notabilis*; viz, a male taken by A. H. Verrill at Samaná, Dominican Republic, on February 6, 1907, and a female obtained by E. Kaempfer in the Yuna Swamps (probably near the mouth of the Río Yuna opposite Sánchez) on October 22, 1922.

MICROLIGEA PALUSTRIS VASTA Wetmore and Lincoln

BEATA GROUND WARBLER

Microligea palustris vasta WETMORE and LINCOLN, Proc. Biol. Soc. Washington, vol. 44, Oct. 17, 1931, p. 121 (Beata Island, Dominican Republic).

The discovery of a ground warbler of this type in the dry scrubs of Beata Island was entirely unexpected, as the typical form, *Microligea palustris palustris*, is found principally in the rain forests of the mountains of Hispaniola, where it inhabits thickets and dark ravines, and is observed with some difficulty. The Beata form was noted only in the dense scrub of the interior of the island and was not observed in the more open growth near the coast. It was common and in fact was one of the first small birds that we observed. As we walked slowly along a narrow trail early on the morning of May 11, alert for creatures of any kind that might be strange to us, a small greenish bird with a gray head came hopping through the twigs of a tree and singing a low song. A moment later it was in hand and was recognized instantly as a form new to science. These warblers proved to be

common, so that during the few days of our stay we obtained a small series. They had considerable curiosity and came out on open limbs to peer about when interested. Their movements were slow and leisurely, and they were usually found in pairs, being evidently near the breeding season. The song resembled *whew whew whew* given in a low tone, and their calls, also low, were querulous and complaining.

On our return from Beata we were astonished to obtain two specimens in the desert area north of the Río Yaque del Sur, beyond Habanero, which brought to attention an early record of one skin collected by Dr. W. L. Abbott at Trujín, on the coast south of Enriquillo, on February 11, 1922. These three skins are distinctly of the paler coloration that characterizes the bird of Beata, and appear to be within the range of color variation for that race. They are identified at this time as *vasta* with the suggestion that further specimens be obtained for comparison when practicable, as with extensive material the main island skins might prove separable. It may be noted that the skin from Trujín, listed by Wetmore¹² in earlier studies with a series of the typical race, is an immature individual with the greenish wash on the fore portion of the body usual in birds in this stage, so that because of this masking of the paler markings its differences were entirely overlooked in previous examination.

In the collections of the American Museum of Natural History there is a series of six adult birds of this species collected by R. H. Beck at Santo Domingo City, September 28 and October 5, 6, 7, 9, and 16, 1917, that are somewhat brighter green on the back than adult specimens from the interior mountains, and are also slightly lighter gray on the head. They thus show a slight approach to the paler coloration characteristic of *M. p. vasta* but are nearer to true *palustris*. Two immature skins from the same locality agree with the adults in this slight difference.

Microligea palustris vasta differs from typical *M. p. palustris* in being decidedly paler, both above and below, and in having the under surface with the white of the breast and abdomen more extensive, and the sides and flanks distinctly lighter. The gray of the crown and hindneck is paler and the green of the back, rump, and wing is lighter. *M. p. vasta* is slightly smaller. Following is the description of the type specimen of *vasta*:

Type, U.S.N.M. No. 327859, male adult, collected on Beata Island, Dominican Republic, May 13, 1931, by A. Wetmore and F. C. Lincoln (orig. no. 8741). Crown, hindneck, and upper back storm gray; auricular region smoke gray; a white spot on upper and lower eyelids, and a slight mixture of white in lores producing a faintly indicated streak or line; back, rump, wing coverts, and exposed edges of secondaries and inner primaries between mignonette green and Krönberg's green, primaries otherwise dusky, the outer ones edged with olive-

¹² Wetmore and Swales, U.S.Nat.Mus.Bull. 155, 1931, p. 395.

gray; exposed webs of rectrices Krönberg's green, hidden portions duller; sides and flanks pale smoke gray, merging into pale olive-gray across upper chest, with throat, lower chest, abdomen, and under tail-coverts whitish; bill dusky mixed with whitish on center of lower mandible; tarsus blackish slate (from dried skin).

Measurements of our series are as follows:

Males (7 specimens): Wing 60.3–66.4 (63.1), tail 51.5–65 (59.6), culmen from base 13.9–15.3 (14.5), tarsus 19.5–21.4 (20.6) mm.

Females (10 specimens): Wing 56.1–67.8 (60.7), tail 58–64.5 (61), culmen from base 14–15.4 (14.4), tarsus 19.3–21.5 (20.3) mm.

Type, adult male: Wing 66.4, tail 63.5, culmen from base 14, tarsus 21 mm.

MICROLIGEA MONTANA Chapman

CHAPMAN'S GROUND WARBLER

Microligea montana CHAPMAN, Bull. Amer. Mus. Nat. Hist., vol. 37, May 14, 1917, p. 330 (Loma Tina, Provincia de Azua, Dominican Republic).

In the rain forests of the Pic de Macaya this warbler was fairly common from April 14 to 20, and a series of six was taken. The birds were most numerous from 1,300 to 1,800 meters, and were found usually in pairs feeding through the branches of low trees.

GEOTHLYPIS TRICHAS BRACHIDACTYLA (Swainson)

NORTHERN YELLOWTHROAT

Trichas brachidactylus SWAINSON, Animals in menageries, 1838, p. 295 (northern provinces of United States).

At Terrier Rouge, Haiti, on March 28, we saw a number of yellowthroats and collected two which belong to the present race. They were found again in the La Hotte region, but as none were collected allocation of records under the present race is on basis of probability. On April 7, between Geffrard and Deron, they were very common wherever there were openings in the forest, being found especially on the cultivated slopes above Les Glaces. On April 8 a few were seen at Deron, on April 9 we found them on the ridge of Bois Pin Lacadonis, on April 10 and 24 at Bois Lacombe, and on April 12 at La Cour Z'Anglais. On the Pic de Macaya they were found in numbers from April 13 to 21 in weed patches in the plantations below the rain forests, as well as over the summit of the peak in the great expanses of bracken that grew beneath the pines. On Île à Vache several were recorded on April 28 and 29.

SETOPHAGA RUTICILLA (Linnaeus)

REDSTART

Motacilla ruticilla LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 186 (Virginia).

The redstart was first observed at Terrier Rouge on March 28. In the La Hotte region, where it was fairly common, we found it at

Donté, April 7; Deron, April 8 (adult male taken); Bois Pin Lacadonis, April 9; Desbarriere, April 10; La Cour Z'Anglais, April 12; Pic de Macaya, April 16, 18, and 19 (female taken); and Bois Lacombe, April 24. On Macaya they were not observed above 1,500 meters elevation. On Île à Vache we observed two on April 29 and one on April 30. Near Belladère we recorded an adult male on May 6.

A representation of this species is found in Edwards's Gleanings of Natural History, vol. 5, 1758, pl. 257, taken from a specimen secured by Thomas Stack on November 1, 1751, about 10 leagues from the coast of Hispaniola.

Family PLOCEIDAE, Weaver Finches

TEXTOR CUCULLATUS CUCULLATUS (Müller)

BLACK AND YELLOW MANTLED WEAVERBIRD

Oriolus cucullatus P. L. S. MÜLLER, Vollst. Natursyst., Suppl., 1776, p. 87 (Senegal).

Our investigations have given some additional data on the distribution of this introduced species. On March 31 we saw several near Pont de l'Estère, Haiti, and collected one. On May 5 we observed a nesting colony near a house 2 kilometers north of Trouin. Near Thomazeau on May 22 we found two colonies, one in an enclosed yard above a native house and the other in a tree top at the border of a road not far from the Étang Saumâtre. One young bird about a week old that fell from a nest and a series of adults were taken. Flocks were noted feeding through the open pastures. Between Port-au-Prince and L'Arcahaie on May 23, several nesting colonies were observed, and little flocks of the birds were found scattered through the dry scrub growth along the highway. The adult males are particularly striking in appearance, their brilliant colors showing especially to advantage when the birds are on the wing.

These weavers seemed appreciably more abundant than they were 4 years previously.

Family ICTERIDAE, Blackbirds and Troupials

AGELAIUS HUMERALIS (Vigors)

TAWNY-SHOULDERED BLACKBIRD

Leistes humeralis VIGORS, Zool. Journ., vol. 3, Nov. 1827, p. 442 (near Havana, Cuba).

These blackbirds were detected only once, on March 31, at Pont de l'Estère, Haiti, when an adult female was collected and another seen. This locality is on the plains a short distance north of the Artibonite, and is the region in which the species was first discovered.

The two seen were in low mesquite trees in a dry pasture several hundred yards from the Estère River. Attention was attracted to them by a redwinglike call, and it was noted that they jerked the tail and flitted the wings in a fashion characteristic of this genus.

ICTERUS DOMINICENSIS (Linnaeus)

HISPANIOLAN ORIOLE

Oriolus dominicensis LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 163 ("Domicia"—Hispaniola).

The Hispaniolan oriole was recorded rather generally in the regions that we traversed, although it was not seen in the higher altitudes of the La Hotte region, on Île à Vache, nor on Beata Island. We observed a few on March 25 near Limbé and Plaisance, Haiti. At Terrier Rouge, Haiti, March 27 to 30, several were seen on the slopes of Morne des Mammelles, and along a dry arroyo through the mesquite. A specimen was taken there on March 28. The oriole was noted further at Deron, April 24; at Las Cahobes, May 20; at Thomazeau, May 22 (specimen); and at L'Arcabaie, May 23. On May 7, and again on May 19, we observed several in the arid section between San Juan and Barahona, Dominican Republic. A specimen was taken on May 9 at La Cienaga, about 15 kilometers south of Barahona. The birds were observed there in pairs and were seen on several occasions flying for considerable distances with quickly undulating flight above the trees. A female in first-year plumage, with black only on the throat and occasional scattered feathers on the lower surface, taken on May 22, was laying.

The late Dr. Charles W. Richmond has called attention to *Pendulinus viridis* Vieillot,¹³ described from "Saint-Domingue", which applies in the synonymy of *Icterus dominicensis* (Linnaeus), the species here under consideration. This was overlooked in the account by Wetmore and Swales in their work on the Birds of Haiti and the Dominican Republic.

HOLOQUISCALUS NIGER NIGER (Boddaert)

HISPANIOLAN GRACKLE

Oriolus niger BODDAERT, Table Planches Enl., 1783, p. 31 (Hispaniola).

In the vicinity of the delightful residence of R. L. Pettigrew, at Terrier Rouge, Haiti, we found this bird fairly common from March 27 to 30. Several usually could be seen about the lawns and gardens in much the same manner as purple or bronzed grackles. They also were noted near Dessalines, Limbé, and Cap-Haïtien on March 25. On our trip into the mountains of the Tiburon Peninsula they were recorded at Deron, April 8; between Deron and Bois Pin Lacadonis,

¹³ Nouv. Dict. Hist. Nat., vol. 5, 1816, p. 321.

April 9; at La Cour Z'Anglais, April 12 and 23; and at Les Glaces, April 24. At the last point we camped for the night on a grassy bench above the river, and had numbers of grackles around us throughout our stay. It was always something of a surprise to find them in heavy tree growth above the coffee plantations. The species was very common on Île à Vache, April 27 to 30, and a few were seen near L'Arcahaie, May 23.

Grackles were observed regularly along our road from Port-au-Prince, Haiti, to Barahona, Dominican Republic, on May 6 and 7, and on the return trip on May 19 and 20. They were common at Barahona on May 9, and a few were found in the scrub near the coast on Beata Island, May 10 to 15. A few specimens obtained at this point are in worn dress and have lost much of the gloss on the dorsal surface that is so prominent in birds in fresh plumage.

Family THRAUPIDAE, Tanagers

SPINDALIS DOMINICENSIS (Bryant)

HISPANIOLAN SPINDALIS

Tanagra dominicensis BRYANT, Proc. Boston Soc. Nat. Hist., vol. 11, May 1867 p. 92 (Hispaniola).

This tanager was among the most conspicuous of the smaller birds of the La Hotte region during our work there in April. We observed it first after leaving Geffrard on April 7, and on our return on April 26 recorded it in small numbers as far as the region between Post Avancé and Camp Perrin. At our camp on Pic de Macaya this was the most abundant bird, ranging from an altitude of 900 meters over the slopes of the mountain to the summit. In the native plantations it was found among growths of low bushes and weeds, and it was continually in evidence in the shrubbery and bush growths about our camp. In the forest the spindalis ranged through the upper branches of the deciduous trees and was the most active member of the forest avifauna, so that any small bird in the tree tops that was not clearly seen was almost certain on investigation to be this species. The period of our work was the beginning of the breeding season, and we heard these birds giving low, sibilant songs in addition to their low calls. They were seen feeding on pokeberries.

In our series of 16 specimens there are two males taken on April 18 and 20 that are molting from a dull immature plumage, resembling that of the female, into bright adult dress.

Wetmore and Swales¹⁴ listed this species under the name *Spindalis multicolor* (Vieillot),¹⁵ having overlooked the fact that Bangs and

¹⁴ U.S.Nat.Mus.Bull. 155, 1931, p. 414.

¹⁵ *Tanagra multicolor* Vieillot, Tableau Enc. Méth., vol. 2, 1823, p. 775 ("Florides, les îles Bahama et de Saint-Domingue").

Penard¹⁶ were correct in indicating that Vieillot's name applies to the *spindalis* of the Bahamas. On checking over Vieillot's account, it is found that his description is that of the Bahaman bird, since it is indicated throughout that the species described has a black back, *Spindalis zena* of the Bahamas being the only species of the genus with this marking. The form of Hispaniola must therefore be known as *Spindalis dominicensis* (Bryant).

PHAENICOPHILUS POLIOCEPHALUS POLIOCEPHALUS (Bonaparte)

GRAY-CROWNED PALM Tanager

Dulus poliocephalus BONAPARTE, Rev. Mag. Zool., 1851, p. 178 (Haiti).

On April 11 we observed two of these birds in thickets near the river at La Cour Z'Anglais, and from April 13 to 20 recorded them as fairly common on the slopes of the Pic de Macaya, where they ranged from the forest border above our camp to the summit of the mountain. They were found in the upper tree branches, where they worked actively about in search of food. Four specimens were secured. Others were seen at Bois Lacombe on April 24, and on April 25 and 26 we found them along the trail between Les Glaces and Post Avancé.

PHAENICOPHILUS POLIOCEPHALUS TETRAOPES Wetmore and Lincoln

ÎLE À VACHE PALM Tanager

Phaenicophilus poliocephalus tetraopes WETMORE and LINCOLN, Auk, vol. 49 1932, p. 36 (Île à Vache, Haiti).

In the study of the palm tanagers obtained on Île à Vache by the Parish Expedition of 1930,¹⁷ it appeared that these birds were somewhat different from those of the adjacent Tiburon Peninsula, but with only one adult and two immature birds at hand the characters that mark this race were not clearly evident. With this in mind we made definite effort to collect specimens, and between April 28 and 30 we secured seven adult birds. These are sufficient to demonstrate that the bird of Île à Vache differs from *P. p. poliocephalus* in having the gray of the upper surface, crown, and hind-neck lighter, the dorsal surface lighter green, and the abdomen more whitish. The bill is slightly longer. Curiously enough the paler coloration of this new race is in the direction of *P. p. coryi* of Gonave Island, but as this is on the opposite side of the Tiburon Peninsula there can be no definite connection between the two. One bird in the Abbott collections from Grande Cayemite Island shows some approach to *P. p. tetraopes* in lighter coloration, but it can have no direct connection since this locality likewise is on the north side of the Tiburon Peninsula, opposite Gonave.

¹⁶ Bull. Mus. Comp. Zool., vol. 67, June 1925, p. 207.

¹⁷ Proc. U.S. Nat. Mus., vol. 81, art. 2, July 22, 1932, p. 39.

Following is a description of the type specimen:

Type, U.S.N.M. No. 327924, male adult, in slightly worn plumage, collected on Île à Vache, Haiti, April 28, 1931, by A. Wetmore and F. C. Lincoln (orig. no. 8637). Anterior portion of crown, lores, and sides of head black, with white spots on each side of forehead, and on both upper and lower eyelids; posterior portion of crown and hind-neck neutral gray; back and scapulars warbler green; rump and upper tail-coverts similar with the feathers tipped lightly with pyrite yellow; wing feathers dusky brown, with exposed portions warbler green, edged externally with pyrite yellow; wing coverts warbler green, edged with pyrite yellow; chin white with this color extending back as a broad malar stripe on each side of the throat; under surface neutral gray washed with whitish on the abdomen and median under tail-coverts; bend of wing pyrite yellow; under wing-coverts light mouse gray, with the feathers edged with whitish. Bill black, becoming slate color at the base of the lower mandible; tarsus and toes blackish slate (from dried skin).

The series available has the following measurements:

Males (four specimens): Wing 82.2-90.5 (85.9), tail 69.5-72.8, (70.8), culmen from base 20-20.8 (20.2), tarsus 22.3-23.7 (23) mm.

Females (four specimens): Wing 81.4-83.7 (82.5), tail 67.5-69.5 (68.7), culmen from base 19.5-21.2 (20.3), tarsus 21-22.8 (21.9) mm.

Type, male: Wing 85.9, tail 72.8, culmen from base 20, tarsus 23.6 mm.

The four-eyes, as this bird is called locally, was found in thickets feeding through the branches or near the ground indifferently. While sprightly in actions, at times it appeared rather indolent, moving slowly with frequent pauses.

PHAENICOPHILUS PALMARUM PALMARUM (Linnaeus)

HISPANIOLAN PALM TANAGER

Turdus palmarum LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 295 (Hispaniola).

This palm tanager was seen at Dessalines on March 25, and at Trou the following day a breeding female was taken. Near Terrier Rouge, from March 27 to 30, they were common in areas grown with thickets, and two more specimens were collected. They have considerable curiosity and often come near to peer at an intruder or to scold at some snake or other animal that worries them. We saw one near Miragoane on April 5.

On May 6 we recorded one at Las Matas, and between San Juan and Azua on May 7 saw several. Between Barahona and San Juan on May 19 we recorded a number and took one north of Habanero. On May 23 near L'Archaie we found them fairly common and collected one young bird in juvenal plumage.

TANAGRA MUSICA (Gmelin)

HISPANIOLAN EUPHONIA

Pipra musica GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 1004 (Hispaniola).

We recorded this handsome little tanager only in the forests of the La Hotte region, where its presence was oftener indicated by its whistled calls than by sight of the bird itself. It was first recorded near Donté on April 7. Near Deron on April 8 and 9 it was fairly common, and it was found between that point and Desbarriere on April 9 and 10. On the slopes of the Pic de Macaya it was recorded from an elevation of 900 meters to the summit of the mountain, and a mated pair was taken here on April 18. We found it near Les Glaces on April 24, and the following day recorded it from the trail as far as Post Avancé.

CALYPTOPHILUS TERTIUS TERTIUS Wetmore

LA HOTTE CHAT-TANAGER

Calyptophilus tertius WETMORE, Smithsonian Misc. Coll., vol. 81, no. 13, May 15, 1929, p. 2 (higher slopes of La Hotte, Haiti).

On April 12, Wetmore had a view of one of these chat-tanagers on the slopes of Pic de Macaya at an elevation of 1,000 meters, between La Cour Z'Anglais and our camp above Caye Godet. The bird was in a steep-sided gulch near the border of forest. We searched for others carefully in the area that we covered near our camp but were not successful in finding them.

Family FRINGILLIDAE, Grosbeaks, Sparrows, Finches, and Buntings

TIARIS OLIVACEA OLIVACEA (Linnaeus)

YELLOW-FACED GRASSQUIT

Emberiza olivacea LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 309 (Hispaniola).

This grassquit is one of the common lowland birds of Hispaniola, found abundantly through the cultivated fields but not occurring in regions of forest. Between Ennery and Plaisance many were seen on March 25 feeding in patches of grass along the road, and the following day we observed it at Trou. At Post Avancé we found it on April 6, and recorded it also at Bois Lacombe, April 11; La Cour Z'Anglais, April 12 and 22; and Les Glaces, April 24. Many were observed between Camp Perrin and Aux Cayes on April 26. On Île à Vache on April 29 we collected two adult males and found a nearly finished nest in the side of a clump of grass half a meter above the ground.

On May 5 many were observed between Port-au-Prince and Jacmel, the birds being especially common where the highway led through canefields. On May 6 and 7, and again on May 19 and 20, they were seen regularly along the road between Port-au-Prince and Barahona. They were common near L'Areahaie on May 23.

TIARIS BICOLOR MARCHII (Baird)

MARCH'S GRASSQUIT

Phonipara Marchii BAIRD, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 297 (Jamaica).

Near Terrier Rouge, Haiti, these birds were common through the dry scrubs and four were collected on March 27 and 28. We saw them at Donté on April 7, and collected one and observed others at La Cour Z'Anglais on April 12. One was recorded on Île à Vache on April 29. On May 20 we observed these birds in fair numbers along the highway between San Juan, Dominican Republic, and Port-au-Prince, Haiti.

LOXIGILLA VIOLACEA AFFINIS (Ridgway)

HISPANIOLAN BULLFINCH

Pyhrrulagra affinis "(Baird)" RIDGWAY, Auk, 1898, p. 322 (Port-au-Prince, Haiti).

In northern Haiti we first encountered the bullfinch on March 26 near Trou, where we observed half a dozen and collected a breeding male. Near Terrier Rouge these birds were common from March 27 to 30, being noted especially in the scrub on the Morne des Mammelles. Here we collected five specimens. In the humid La Hotte region the bullfinch was even more abundant, being observed between Geffrard and Donté, April 7; at Bois Lacombe, April 10; and between Desbarriere and La Cour Z'Anglais, April 12. On the Pic de Macaya this was one of the common birds from April 14 to 22, ranging through the rain forest to the summit of the mountain. On our way out we found it at Bois Lacombe on April 23 and Les Glaces on April 24, and later on May 6, observed it along the highway between Belladère and San Juan, Dominican Republic.

The period of our work in the La Hotte area was seemingly the breeding season for this form, as its pleasant, whistled song, in tone and utterance suggestive of the cardinal of the Southern United States, was heard regularly and was in fact the earliest bird voice of the morning that frequently aroused us at daybreak when we were camped in the forest, or in native huts surrounded by shrubbery. The song was continued for an hour or more in early morning and was heard occasionally during the day, being especially attractive in an area where comparatively few birds were pleasing songsters.

LOXIGILLA VIOLACEA PARISHI Wetmore

PARISH'S BULLFINCH

Loxigilla violacea parishii WETMORE, Proc. Biol. Soc. Washington, vol. 44, Feb. 21, 1931, p. 27 (Île à Vache, Haiti).

During our work on Île à Vache we collected five specimens of this bullfinch on April 28 and 30, including three males and two birds in immature dress. These exhibit the average difference in smaller size that distinguish this race from *L. v. affinis* of adjacent Haiti. The three males have the following measurements: Wing, 69, 72, 74.5; tail, 64.7, 64.8, 64.8; culmen from base, 14.5, 14.7, 15.3; tarsus, 20.3, 20.5, 22.1 mm. The largest of these is equal to the smallest specimens of *L. v. affinis*, but the average of that race is distinctly larger, and no bird seen from the main island is equivalent to the smaller skins from Île à Vache. With its circumscribed insular range *parishi* may be maintained as distinct.

During our work on Beata Island, from May 11 to 15, we found bullfinches common, and collected a series of seven birds, including four males, one female, and two immature individuals. On examination it is found that these have the small average size of *parishi* and are identified as of that race. Though this may at first sight seem hardly probable, it will be recalled that both Île à Vache and Beata lie on the south coast of Hispaniola and in reality are not far apart. It may be considered that on these two islands there is maintained a small race that formerly was more widely distributed. The two immature birds from Beata are molting into adult dress and have only a part of the immature plumage remaining, this part being distinctly lighter in color than juvenile dress in other specimens examined, including those from Île à Vache. In view of the arid conditions that hold on Beata Island, with intense sunlight, it seems probable that this paler coloration is due to fading, and it is thus interpreted. Following are measurements of the four males from Beata: Wing, 71.6, 72.2, 73.1, 74.6; tail, 57.5, 60, 61, 62.4; culmen from base, 14.5, 14.7, 14.8, 14.9; tarsus, 20.1, 20.7, 20.8, 21.7 mm. Here again there is approach to the smallest dimension found in *L. v. affinis*, but the average and the smaller specimens from Beata are similar to those from Île à Vache.

On Île à Vache these birds were fairly common in thickets and low woodland, seeking heavy cover and ordinarily remaining under concealment. On Beata they were more numerous and, though they remained under shelter, were called out where they could be observed without difficulty. We commented frequently during our work there that though this was the breeding season the only songs that we heard from these birds were low and sibilant, quite different from the clear, whistled efforts of their main-island neighbors. It is possible, of course, that the usual song was given at dawn as our camp was on

the shore, a little distance from the usual haunt of the bullfinches, but if this were true it is curious that we did not detect it, since we were out at daybreak daily and even when at camp were within hearing distance of the scrubs inhabited by these finches.

On May 15 we found a nest placed in a thorn bush a little more than a meter from the ground. The nest was relatively large, was deeply cupped, and was constructed of grass and weed stems that were arched up to form a dome over the top so that the interior was completely shaded. It contained four fresh eggs, with the ground color decidedly lighter than pale glaucous-green, spotted finely with warm sepia, the spots being more or less confluent at the larger pole of the egg and there forming a wreath. The eggs measure 22.4 by 14.7, 22.4 by 15, 23 by 14.3, and 23.4 by 15 mm.

Another nest that had just been completed was located in a bush a little more than half a meter above the ground and was of similar construction, with the top partly covered.

AMMODRAMUS SAVANNARUM INTRICATUS Hartert

DOMINICAN GRASSHOPPER SPARROW

mmodramus savannarum intricatus Hartert, Bull. Brit. Orn. Club, vol. 19, Apr. 29, 1907, p. 73 (El Valle, Dominican Republic).

Our first view of the grasshopper sparrow came on May 20, when we saw one or two by the highway a short distance west of San Juan, Dominican Republic. Later that same day, in a rolling prairie region east of Las Cahobes, Haiti, we located two small colonies and collected four birds in fine adult plumage. They were distributed through areas of grass growing on hill slopes and flew out to alight in guava bushes near the ground or to drop back again into the grass.

REVIEW OF THE WASPS OF THE SUBFAMILY PSENINAE OF NORTH AMERICA (HYMENOPTERA: ACULEATA)

By J. R. MALLOCH

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INTRODUCTION

This paper is the result of some work done several years ago and brought up to date now in order to make available to entomologists the data accumulated in working over the collections in the United States National Museum and the Bureau of Biological Survey. Originally started as a joint undertaking with S. A. Rohwer, of the Bureau of Entomology, the matter is presented by the author alone because press of work on other subjects compelled his collaborator to give up the project after making an examination of the Fox and Cresson types in Philadelphia in 1926. The author regrets that this action was forced upon his colleague and accepts the full responsibility for the matter presented herein.

All material except four specimens of a few of the more common species, retained in the collection of the Bureau of Biological Survey for purposes of comparative work in connection with the examination of stomach contents of birds and mammals by the Division of Food Habits Research, will be found in the collection of the United States National Museum, and all type specimens of new species except one are deposited in that institution.

TAXONOMIC TREATMENT

The group is herein accepted as a subfamily of the family Psenidae, Pemphredoninae being the other subfamily of that family.

There has been considerable confusion in the North American literature regarding the application of the generic names in Pseninae, and also in determining the limits of the genera. It is with the purpose of clearing up the status and relations of these and their species that this paper is published. A careful examination has been made of the genotypes, and the decisions as to the validity of the various genera are based upon these examinations. The type specimens of most of the species described by Cresson, Fox, Packard, and Viereck have been examined to determine their status, and every

effort has been made to use in the keys and descriptions characters which it is hoped will clearly distinguish the species included in the paper. It must not be supposed that the tyro will be able at once to determine species with these data in hand, as the insects are not at all easy to determine, but with the aid of the figures and careful descriptions of the various structures of the species presented herein it is we hope a possibility for any capable hymenopterist to establish definitely the identity of the included species.

I find in this group, as I previously discovered in Tiphinae, a great similarity in the hypopygia of closely allied species, and consequently I have made but little use of these organs in distinguishing species. It may be noted, however, that there are several species in which the hypopygia are quite distinctive, that the ultimate and penultimate segments show more appreciable distinctions for the differentiation of species, and that the ultimate segment in *Diodontus* and *Psen* has a longer, more curved, and much sharper pointed apical process than does *Psenia*. In *Psen* the process is very acute, bare at apex, and stinglike, while in *Psenia* it is flat, rounded at tip, and furnished with microscopic hairs, the longer of which are at the tip.

There are characteristic features in the anal lobe of the hind wing of the various genera, but I have not made use of these in my keys, as there is difficulty in determining the exact form of the lobe in most specimens in collections because of the folding or warping of the wings.

The wasps are solitary, making their nests in stems of plants, in wood, or in the earth, and provisioning them with Hemiptera, mostly small leaf-hoppers. The museum collection contains large series of two species which were reared from cocoons found in the earth, but there are no records of the food habits of the species on the attached labels. Nothing is known of the parasites of the North American species, nor in fact if there are any.

KEY TO THE GENERA OF PSENINAE

1. Cubitus of hind wing with its base proximad of median transverse vein; occipital carina connecting with the carina surrounding mouth cavity considerably distant from median line of venter of head..... ***Psen* Latreille**
Cubitus of hind wing with its base distad of median transverse vein..... 2
2. Occipital carina connecting with the carina surrounding the mouth cavity considerably distant from median line of venter of head; face with a prominent median carina, which lies between bases of antennae and connects with a raised line which extends from each side of face below antennal bases..... ***Diodontus* Curtis**
Occipital carina carried around back of head and not connected with the one surrounding the mouth cavity, sometimes rather widely separated from the latter on median line of venter of head; face without a prominent carina as above, and lacking lateral transverse raised lines.

***Psenia*, new genus**

Genus **DIODONTUS** Curtis

Diodontus CURTIS, Brit. Ent., vol. 1, p. 496, 1834. (Genotype, *Psen pallipes* Panzer, by original designation.)

Neofozia VIERECK, Trans. Amer. Ent. Soc., vol. 27, p. 338, 1901. (Genotype, *Psen atratus* Panzer, by original designation.)

Distinguished from the other genera of Pseninae by the presence of a prominent vertical carina between the bases of the antennae, which is usually centrally sulcate on at least a part of its extent, and which connects with a more or less curved ridge or carina that runs across the face below the bases of the antennae. The second and third submarginal cells each receive a recurrent nervure (pl. 1, fig.1), and the nervellus of the hind wing is perpendicular or almost so and situated proximad of the base of the cubitus (pl. 1, fig. 1). Occipital carina as in *Psen*, not carried entirely across the ventral surface of the head. Fore trochanters and basal third of the fore femora flattened on ventral surface in females. Pygidial area broad, with very inconspicuous punctures.

The cited genotypes of this concept are accepted as synonyms, and I have before me several examples identified as *atratus* by different European workers which belong to the collection of the National Museum. This species has the petiole of the abdomen similar to that of *trisulcus* Fox, but the propodeum outside of the enclosure is very coarsely rugose, and the head back of the eyes is vertically striate, neither of which characters is found in the North American species.

I present below a key to the North American forms which I consider entitled to specific recognition.

KEY TO THE SPECIES OF GENUS DIODONTUS

- 1. Females----- 2
 Males----- 5
- 2. Petiole of abdomen rounded on sides, without a definite lateral marginal carina on each limit of dorsal surface and without a dorsocentral sulcus except on basal half or less of its length----- 3
 Petiole of abdomen not regularly rounded on sides and below, usually with distinct carinae at least on sides, and always with a well-defined but shallow sulcus on practically entire length of its dorsal surface----- 4
- 3. Propodeum with sides adjacent to enclosure distinctly striate though not very coarsely so; mesonotum with quite deep punctures anteriorly and laterally; petiole of abdomen without any trace of laterodorsal carina even at base----- **frontalis** (Fox)
- Propodeum with very shallow punctures and almost no definite striae adjacent to enclosure; mesonotum very feebly punctate; petiole of abdomen with a slight laterodorsal carina on basal half-- **occidentalis**, new species
- 4. Petiole of abdomen with a very distinct central carina on ventral surface; carina between bases of antennae distinctly sulcate to anterior extremity; larger species, 7 mm or more in length; propodeum almost smooth laterad

- of upper lateral angle of enclosure, becoming gradually more visibly but finely striato-punctate apically, the striae merging into the large lateral rugose areas on the sides..... **sulcatus**, new species
- Petiole of abdomen not distinctly carinate on center of venter, or with no visible sulcus on at least a part of anterior half of carina between bases of antennae; usually smaller species averaging about 5 mm in length; propodeum with fine but distinct striae on area bordering enclosure on entire dorsal aspect..... **trisulcus** (Fox)
5. Petiole of abdomen not sulcate in center of dorsum and without laterodorsal carinae; vertex glossy, with fine, rather shallow, scattered punctures, **frontalis** (Fox)
- Petiole of abdomen with a very well developed carina on each side and very distinctly though shallowly sulcate on practically its entire length on dorsum..... 6
6. Entire vertex glossy, with very minute, shallow, and rather close punctures, **corusanigrens** Rohwer
- Vertex at least partly striate or striato-punctate, the punctures larger and denser above and on sides, striae best seen when head is viewed at an angle from side..... **trisulcus** (Fox)

DIODONTUS FRONTALIS (Fox)

Psen frontalis Fox, Trans. Amer. Ent. Soc., vol. 25, p. 4, 1898.

In common with all the other species of the genus, including those of Europe, this species is shining black, with silvery hairs on most of the body, most evident on the head and especially the face, the tarsi mainly yellow, the fore pair entirely so, and the fore tibiae largely of that color. The antennal flagellum is usually of a more or less noticeable testaceous-yellow color on most of its length below, and the wings are hyaline, with the stigma fuscous.

Structurally the entire membership of the genus is very similar, and it is only by means of the rather minute characters cited in the above key that it is possible to distinguish them. Trivial though these characters appear at first sight, there is very little variation in them, and I believe they are entirely reliable for specific distinctions.

Originally described from Utah and Las Cruces, N.Mex. There are before me 2 females and 1 male, 1 female with the locality Boulder, campus of the University of Colorado, July 4 (T. D. A. Cockerell), and the other pair with merely the State label from the Baker collection.

The male was unknown to Fox. When Mr. Rohwer examined the Fox types in Philadelphia he made no notes on that of *frontalis*.

DIODONTUS TRISULCUS (Fox)

PLATE 1, FIGURES 1, 2

Psen trisulcus Fox, Trans. Amer. Ent. Soc., vol. 25, p. 5, 1898.

This is the only other species of the genus than the preceding one known to Fox and as Mr. Rohwer did not examine the type when in

Philadelphia the matter of accurate identification of the species is rather doubtful, though I believe I am correct in accepting it as the most common eastern form now before me.

In September 1923 and May and July 1924, I collected about 100 specimens in the backyard of a city residence on Twenty-first Street, NW. in Washington, D.C., where both sexes were common flying alongside of a honeysuckle vine, which covered an old wooden out-building. I found the males to far outnumber the females, and did not discover the nesting places. It is highly probable that the species made its nesting burrows in the old building, as a specimen in the United States National Museum taken at Hyattsville, Md., bears a label with the wording "boring in wood." I have taken this species also at Glencarlyn, Va., in May, and have seen it from Greene County, N.Y., and St. George, Utah.

There is considerable difference in the sculpture of the propodeum in the sexes, the male having the areas bordering the enclosure very coarsely rugose, while the same areas in the female are only finely and closely striate.

Hypopygium of male as in plate 1, figure 2.

DIODONTUS CORUSANIGRENS Rohwer

Diodontus corusanigrens ROHWER, Proc.U.S.Nat.Mus., vol. 57, p. 229, 1920.

I have examined the type series of this species in the National Museum and can find no characters other than the glossy, unstriate, and minutely punctured frons to distinguish it from the preceding species, which it very closely resembles in all other characters. The carina between the bases of the antennae is very sharp and not so long as in the other species, and has but a slight narrow sulcus on the central part, but the carina is evidently rather variable in some of the species of which I have more material, so I do not care to depend upon it as a distinguishing character in this case.

Type locality, St. Louis, Mo. No other locality yet recorded.

DIODONTUS OCCIDENTALIS, new species

Female.—Very similar to *frontalis*, distinguished in the characters listed in the foregoing synoptic key. The vertex is also much less densely punctured than in the older species and has no indications of striae laterally, while the mesonotum has less dense and much shallower punctures.

Length, 6.5 mm.

Type.—U.S.N.M. No. 44204, from Tallac Lake, Tahoe, Calif., July 25, 1915 (E. P. Van Duzee).

DIODONTUS SULCATUS, new species

Female.—A larger species than *trisulcus*, and quite similar in structure, the distinctions consisting of those listed in the foregoing synoptic key. I had some doubt as to the propriety of accepting this as *trisulcus*, the type specimen of which was not examined by Mr. Rohwer, but I finally decided that the smaller and much more widely distributed and common species already dealt with is more likely to prove correctly identified as that species. There are some specimens of *trisulcus* in which the carina between the bases of the antennae has a slight sulcus on the anterior portion, but in such cases the petiole of the abdomen has no ventral median carina and the propodeum is differently sculptured.

The male is not known.

Length, 7–7.5 mm.

Type.—U.S.N.M. No. 44205, from Harrisburg, Pa., 1921 (Champlain). Paratypes, topotypical—1, by the same collector, July 11, 1921; 1, Wetzels Swamp, July 9, 1910; and 1, Carlisle, Pa., June 24, 1910, the last 2 taken by W. S. Fisher.

Genus PSENLUS Kohl

Psenulus KOHL, Ann. Naturh. Hofmus. Wien, 1896, p. 293.

I have examined the genotype, *fuscipennis* Dahlbom, and can find no character other than one of the venation of the fore wing to justify the separation from *Diodontus*. The second cubital cell receives both recurrent nervures in *Psenulus*, while it receives but one in *Diodontus* as a general rule, though at times the first recurrent nervure may be interstitial with the first transverse cubital.

As the group is unrepresented in North America as far as is known at present, it is not necessary to deal further with the matter of the validity of the genus.

Genus PSEN Latreille

Psen LATREILLE Précis des caractères génériques des insectes, etc., p. 122, 1796. (Genotype, *Sphex atra* Fabricius.)

Mimesa SHUCKARD, Essay on the indigenous fossorial Hymenoptera, p. 228, 1837. (Genotype, *Mimesa equestris* Wesmael.)

Dahlbomia WISSMANN, Ent. Zeitung, vol. 10, p. 9, 1849. (Genotype, *Sphex atra* Fabricius.)

There are several rather well marked segregates of this genus in North America to which we give subgeneric status, all of them falling within the genus in its widest sense as limited in the generic synopsis given herein. Following is a key for the separation of these subgenera:

KEY TO THE SUBGENERA OF PSEN

1. Clypeus with two small rounded emarginations at apex, which give it the appearance of having three short acute teeth, the apex distinctly thickened (pl. 1, fig. 3); hind femur with an elongate oval patch of short soft hairs near apex on posterior surface, the piliferous punctures of the patch so close as to give the area covered by it the appearance of an opaque shallow depression (pl. 1, fig. 4); male abdomen without long soft fasciculate hairs at apices of any of the sternites; pygidial area of female narrow, shining, with a few large shallow piliferous punctures along each side and usually a slight longitudinal carina in center; both recurrent nervures received by second submarginal cell of fore wing; petiole of abdomen not sulcate above, with a series of minute piliferous punctures along each side, the hairs very short and inconspicuous..... **Pseneo**, new subgenus
- Clypeus not tridentate, simple, or with a slight central notch or emargination on each side of which there is a more or less evident broadly rounded convexity or tooth, and rarely a second smaller tooth laterad of this; hind femur without an elongate oval patch of hairs on posterior surface near apex..... 2
2. Abdomen of male with soft fasciculate hairs at apex of third, or apices of third and fourth sternites, which project downward and are sometimes very prominent; petiole of abdomen not sulcate and without the usual series of piliferous punctures near each laterodorsal edge; second recurrent vein sometimes interstitial with the one separating second and third submarginal cells, or even entering the third; hind femur bare on upper half of posterior surface and with a rather noticeable series of soft hairs extending from near base to apex below middle of surface, ventrad of which there are numerous fine microscopic hairs..... **Psen** Latreille
- Abdomen of male without fasciculate hairs at apices of any of the sternites; petiole sulcate above and with rather long hairs in lateral sulci, or if not sulcate then with a series of piliferous punctures along each side of the dorsum, the hairs being quite conspicuous; hind femur usually with entire posterior surface evenly covered with microscopic fine hairs..... 3
3. A complete linear carina present on vertex from between bases of antennae to anterior ocellus; abdomen almost always entirely black, petiole always with 2 more or less complete and rather prominent carinae, so that there are at least basally 3 evident dorsal sulci; episternauli distinct, eps 1 glossy and smooth..... **Mimumesa**, new subgenus
- Frontal carina absent or almost so; abdomen almost always partly rufous; petiole usually flattened or convex above, sometimes with faint traces of rounded carinae, never with distinct carinae beyond middle, lateral sulci very shallow or absent, but the hairs always readily distinguishable; episternauli poorly defined, eps 1 not smooth, striate or striato-punctate. **Mimesa** Shuckard

PSNEO, new subgenus

Similar in general habitus to *Psen*, differing essentially in having the clypeus in both sexes with two small rounded emarginations in center at apex, causing it to appear centrally tridentate (pl. 1, fig. 3); the petiole of the abdomen more or less rounded above, without dor-

sal sulci; the hind femur with an elongate oval patch of short pale hairs near apex on the posterior surface (pl. 1, fig. 4); both recurrent veins received by the second submarginal cell; abdomen of male without fasciculate hairs at apices of any of the sternites; and the pronotum in the males frequently with a sharp angle or tooth on each side above.

Subgenotype, *Psen kohlii* Fox.

Fox, in his paper on *Psen*,¹ divided the genus into several groups more or less in accord with the present arrangement, this segregate being referred to as "Group *kohlii*." There are, however, a few characters used in this paper which he did not utilize in his, and he was uncertain apparently as to the application of the character of the tridentate clypeus in both the sexes, while he included *fuscipes* Packard here, which is not in accord with my present findings.

Following is presented a key to the species known to me from North America.

KEY TO THE SPECIES OF SUBGENUS PSENEO

- | | |
|--|--------------------------------|
| 1. Males..... | 2 |
| Females..... | 6 |
| 2. Antennal flagellum with a minute pimplelike elevation on each segment from 2 to 9, inclusive, sometimes more elongate on first three segments..... | 3 |
| Antennal flagellum with a much larger elongate glossy elevation on one side of most of the segments, which makes it appear somewhat monilliform..... | 4 |
| 3. Abdominal petiole black; pronotum spicate on each side. | |
| | <i>spicatus</i> , new species |
| Abdominal petiole red; pronotum not spicate on each side. | <i>angulatus</i> , new species |
| 4. Tibiae and tarsi bright fulvous-yellow, very much paler than the glossy black femora; petiole of abdomen chestnut-red, darker on dorsum; second segment of the antennal flagellum without any raised line.... | <i>kohlii</i> Fox |
| Tibiae always partly or entirely darkened, fuscous, or dark brown, and not very conspicuously paler than the black femora, the tarsi sometimes largely fuscous; petiole of abdomen black, rarely reddish below and on sides..... | 5 |
| 5. Second segment of antennal flagellum without any raised line evident; tarsi normally bright fulvous and conspicuously paler than tibiae. | |
| | <i>simplicicornis</i> Fox |
| Second segment of antennal flagellum with a small but distinct raised line; tarsi dark brown, not noticeably paler than tibiae..... | <i>punctatus</i> Fox |
| 6. Scutellum coarsely longitudinally striato-punctate; petiole of abdomen usually red..... | 7 |
| Scutellum merely punctate, not striate on any part of disk..... | 8 |
| 7. Legs entirely fulvous-yellow; pronotal lobes also of that color; coxae blackened at bases..... | <i>fulvipes</i> , new species |
| Coxae, trochanters, and femora largely black, tibiae usually darkened in part; pronotal lobes black..... | <i>kohlii</i> Fox |

¹ Trans. Amer. Ent. Soc., vol. 25, p. 1, 1898.

8. Petiole of abdomen red; tibiae and tarsi bright orange or fulvous-yellow; scape of antennae fulvous, with a brown mark above.--- *carolina* Rohwer
 Petiole of abdomen black, rarely slightly reddish on sides and below; at least the tibiae dark brown or fuscous in part; scape of antennae black or dark brown.----- 9
9. Pygidial area narrow, at upper extremities of the lateral carinae less than half as wide as its length in middle; tarsi bright orange or fulvous-yellow. *simplicicornis* Fox
 Pygidial area broader, at upper extremities of lateral carinae more than half as wide as its length at center; tarsi hardly paler than tibiae. *punctatus* Fox

PSEN (PSENEO) FERRUGINEUS (Viereck)

Mimesa ferrugineus VIIECK, Trans. Amer. Ent. Soc., vol. 27, p. 341, 1901.

According to notes on the type specimen in Philadelphia made by Mr. Rohwer, this species will run down to *kohlîi* in my key, but it differs from any species I have seen in having the propodeum and basal two abdominal segments and petiole of the abdomen ferruginous. The pronotal lobes and legs are ferruginous, in which respect it is similar to *fulvipes*. As the females usually are darker colored than the males, it is not probable that the specimen described herein as *fulvipes* can be the female of *ferrugineus*, as the propodeum and abdomen except the petiole are entirely black.

Length, 12 mm.

PSEN (PSENEO) KOHLII Fox

PLATE 1, FIGURE 4

Psen kohlîi Fox, Trans. Amer. Ent. Soc., vol. 25, p. 9, 1898. (Male and female.)

Fox distinguished this group as the *kohlîi* group, and I have before me some specimens compared with the type in Philadelphia by Viereck and by Rohwer, and one of these specimens bears a homotype label. It may be pertinent to note here that in addition to the characters listed in the key for the separation of the subgenera, all the species known to me have the hind coxae with a very prominent linear carina on their inner or opposed surfaces, and that the petiole of the abdomen is much more noticeably curved near base than in most of the other segregates.

The present species is readily distinguished from its nearest allies by the characters listed in the above key to the species, the bright fulvous-yellow tibiae and tarsi and red abdominal petiole of the male being quite distinctive. The antennal flagellum of the male has the elevations (sensory areas?) rather broad, distinctly shining though not glossy, highest at center, and most prominent on the sixth to eighth segments, the one on the third segment very inconspicuous

because it is of the same red color as the segment, and the one on second entirely lacking.

Length, 8-11 mm.

Originally described from Pennsylvania and Virginia. Material examined by me is from the following localities: Alabama, no other data; Fort Montgomery, N.Y., August 10, 1923 (F. M. Schott), a female with very dark, almost black, petiole; Huntington, Long Island, N.Y., August 19, 1917 (F. M. Schott), and a female without date, "on *Bidens*" (Bridwell); Plummers Island, Md., August 17, 1907 (A. K. Fisher); Glen Echo, Md., July 23, 1921, July 30, 1922, and August 30, 1923 (J. R. Malloch).

The specimens taken by me were swept from trees and bushes overhanging paths through the woods.

The female specimens with blackish red petiole can readily be distinguished by the rather coarsely striate punctate scutellum.

PSEN (PSENEO) SIMPLICICORNIS Fox

Psen simplicicornis Fox, Trans. Amer. Ent. Soc., vol. 25, p. 10, 1898. (Male and female.)

Mr. Rohwer has reported upon the characters of the type specimens and before me there is a female labeled by him as a homotype. He also notes that though the first locality mentioned by Fox is Virginia, it is the male which is from that State, and being the last to be described consequently this sex is the allotype, not the type.

The male is readily distinguished from that of *kohlîi* by the darkened tibiae and black abdominal petiole. The tarsi are normally as pale as in *kohlîi*, and the second flagellar segment has no raised line, but the third segment has the raised part more prominent and darker than in *kohlîi*. The scutellum in the female is quite definitely longitudinally striato-punctate in *kohlîi*, while in the present species it is sparsely punctate as in the male.

Length, 8-11 mm.

Originally described from North Carolina and Virginia. I have examined specimens from the following localities: Harrisburg, Pa., a series of reared specimens, Wetzels Swamp, September 1908 and April 1909 (P. R. Myers), and one specimen, same locality, November 12, also reared (G. M. Greene); Mount Holly, Pa., June 14, 1921 (Champlain and Knull); Beltsville, Md., August 6, 1916 (W. L. McAtee).

PSEN (PSENEO) PUNCTATUS Fox

Psen punctatus Fox, Trans. Amer. Ent. Soc., vol. 25, p. 9, 1898. (Female.)

I have before me a specimen which was compared with the type and is labeled homotype by Mr. Rohwer, and several specimens which

agree with it in all respects. The characters in the key should suffice for the identification of the sexes.

Originally described from Colorado and subsequently recorded from Nebraska. I have examined specimens in the National Museum, from Boulder, Colo., mostly with definite location as the campus of the university, and the months June, July, and August (T. D. A. Cockerell).

PSEN (PSENEO) CAROLINA Rohwer

Psen (Mimesa) punctata var. *carolina* ROHWER, Proc. Ent. Soc. Washington, vol. 12, p. 103, 1910. (Female.)

Originally described as a variety of *punctatus*, I consider it practically certain that this is a valid species and accept it as such, though the discovery of the male is desirable to confirm this decision.

The pale antennal scape and tibiae and tarsi, coupled with the red petiole, the distinctly yellowish facial hairs, narrower face, and rather greater size, 14–15 mm, distinguish the species from *punctatus*.

Localities, Raleigh, N.C., type, and Fluvanna County, Va.

Type.—U.S.N.M. No. 12363.

PSEN (PSENEO) FULVIPES, new species

PLATE 1, FIGURE 3

Female.—Shining black. Antennae including the scape and basal five segments of the flagellum fulvous-yellow, the apical section of the flagellum dark brown. Lobes of prothorax fulvous. Petiole of abdomen red. Legs except the coxae fulvous. Wings grayish hyaline, veins and stigma dark brown.

Frons glossy, sparsely punctured, a deep impressed line extending entirely across behind the posterior ocelli and curving forward outside of each to its anterior edge; carinate line from anterior ocellus to lower level of antennal insertions complete; basal segment of flagellum subequal to the next two in length. Mesonotum and scutellum rather coarsely rugoso-punctate, the former appearing quite coarsely striate centrally behind; propodeum with a rather large central glossy diamond-shaped area laterad of which it is rather finely rugoso-reticulate, the areas laterad of the enclosure quite coarsely rugoso-reticulate; upper portion of the mesopleura (eps 2) longitudinally rugoso-punctate, the lower portion vertically rugoso-punctate. Petiole convex above, the edges not sharp, the sides with a narrow shallow sulcus; pygidium narrower than in *punctatus*, with a single series of punctures on each side. Otherwise as *punctatus*.

Length, 11 mm.

Type.—U.S.N.M. No. 44206, from Coleta, Ala.; no other data (H. H. Smith).

PSEN (PSENEO) SPICATUS, new species

Male.—Shining black. Antennal scape shining black, flagellum dark dull brown, the basal 4 or 5 segments brownish yellow below; hairs of face silvery white. Prothoracic lobes and abdominal petiole black. Legs black to brownish black, the tarsi more noticeably brown. Wings grayish hyaline, veins and stigma dark brown, the costa with a brown tinge in cell beyond the stigma.

Frons glossy, with large deep punctures, which are contiguous in front and to some extent on sides, the impressed line behind posterior ocelli distinct; antennal flagellum very slightly thickened apically, the basal segment longer than the scape, segments 2 to 9 each with a small pimplelike elevation near middle on one side that is most distinct on 6 to 8 and sometimes slightly linear on 2 and 3. Thorax almost as in *fulvipes*, but the lower part of the mesopleura (eps 1) is less closely punctured and lacks definite rugae; propodeum with the enclosure rugose on entire extent, no smooth central diamond-shaped area present. Petiole as in the preceding species. Legs and wings normal. The most conspicuous feature of the species, and the one which gives it its name, consists of the spikelike projection on each lateral angle of the pronotum.

Length, 10.5 mm.

Type (U.S.N.M. No. 44207) and two paratypes.—From Beulah, N.Mex., August 8, 1900 (T. D. A. and W. P. Cockerell).

PSEN (PSENEO) ANGULATUS, new species

Male.—Differs from *spicatus* in the paler-colored legs, the tibiae being yellowish at base and apices and the tarsi almost entirely yellow. The bases of the flagella are more completely yellow. Petiole of abdomen red.

The antennal structure differs from that of *spicatus* as stated in the key, and the prothorax has the angles very much less produced.

Length, 9 mm.

Type.—U.S.N.M. No. 44208, from Nelson County, Va., August 10, 1924 (W. Robinson); paratype, Roxborough, Pa., September 28, 1908 (C. T. Greene).

Subgenus PSEN Latreille

Reference as under genus, page 6.

Our conclusions as to the identity of this subgenus are based upon an examination of the type of the segregate in the collection of the National Museum. The male differs from that of any found in North America which are retained herein in having the antennal flagellum flattened, most of the segments except a few at the base having an oblique groove or depression on one surface, and the

scape markedly swollen; the mid tarsus is modified, the basal segment having 2 spines on one side and most of the others having some minute black bristles on one side. The abdominal petiole in both sexes is flattened above much as in *monticola* Packard, the wing venation is also as in that species, and the pygidium of the female is rather dull, owing to the presence of microscopic shagreening on its entire surface, while there are rather large piliferous punctures almost evenly distributed over it. The male of the genotype has the fine erect hairs at the apices of third and fourth abdominal sternites more or less matted centrally and forming fasciculae. The antennae and mid tarsi of the males of the North American species are not abnormal in form, nor are they in the females of any of the included species, so that we disregard these as subgeneric characters. The hind coxae lack the sharp carina on inner side so characteristic of *Pseneo*. This was called "Group *monticola*" by Fox. He had but one species.

Below is presented a key to the North American species available to the author.

KEY TO THE SPECIES OF SUBGENUS PSEN

- | | |
|--|--------------------------------------|
| 1. Males..... | 2 |
| Females..... | 5 |
| 2. Only fourth abdominal sternite with fasciculate soft hairs, which are confined to middle of apex and are very short, or the third also with a very short narrow tuft of such hairs on central line at apex; petiole of abdomen evenly rounded above, without angular lateral edges; entire abdomen shining black..... | 3 |
| Third and fourth abdominal sternites each with prominent fasciculate hairs at apices, which extend almost across ventral exposure of apices; petiole flattened above, lateral edges quite sharp; abdomen partly red..... | 4 |
| 3. Petiole of abdomen slightly angulate along sides, but without a distinct lateroventral carina; mesopleura with large, deep, almost contiguous punctures on most of its surface..... | unifasciculatus , new species |
| Petiole of abdomen with a distinct raised marginal line or carina on each lateral edge of its ventral surface; mesopleura with quite small, shallow, isolated punctures on most of its surface..... | myersiana (Rohwer) |
| 4. Petiole of abdomen red, remainder of abdomen black; antennal flagellum simple; mesonotum except the anterior lateral portions coarsely striatopunctate; second recurrent nervure generally entering second submarginal cell close to its apex..... | erythropoda Rohwer |
| Petiole black, remainder of abdomen red; flagellar segments 3 to 10 each with an elongate swelling or carina along one side; second recurrent nervure generally entering third submarginal cell a little beyond its base (pl. 1, fig. 5)..... | monticola (Packard) |
| 5. Abdomen, femora, and tibiae black; clypeus with two short rounded teeth at apex, which are rather close together; petiole evenly rounded above; pygidial area narrow, almost glossy, the shagreening noticeable only at apex, and with a series of fine hairs along sides.... | myersiana (Rohwer) |

- Abdomen in part, and tibiae entirely, reddish yellow; clypeus not toothed, petiole slightly flattened above, with a rather pronounced ridge or carina along each laterodorsal edge; pygidial area broader, densely shagreened and dull on all, or a large part, of its surface..... 6
6. Petiole of abdomen red, remainder of abdomen black; pygidial area entirely shagreened and dull, with a series of fine hairs along each side; mesonotum coarsely striato-punctate on almost entire extent.

erythropoda Rohwer

Petiole black, remainder of abdomen red; pygidial area shagreened on rather more than its apical half and on sides, glossy basally, and with several series of stiff hairs apically and laterally; mesonotum with fine separated punctures on its entire extent..... monticola (Packard)

PSEN (PSEN) MONTICOLA (Packard)

PLATE 1, FIGURES 5, 6

Mimesa monticola PACKARD, Proc. Ent. Soc. Philadelphia, vol. 6, p. 407, 1867.
(Male.)

This species is readily recognized in both sexes by the bright-red abdomen and its black petiole. The clypeus has a rather broad central transverse extension that lacks definite lateral teeth. Wing venation as in plate 1, figures 5 and 6.

Length, 8-10 mm.

Localities: Mount Washington, N.H. (Packard); Philadelphia, Pa. (Fox); Glen Echo, Md., July 1 to 23, 1921 to 1923 (J. R. Malloch); Plummers Island, Md., July 28, 1912 (H. L. Viereck); Glencarlyn, Va., July 14, 1907 (F. Knab); Georgetown, D.C. (H. H. Smith); Rosslyn, Va. (H. H. Smith); Falls Church, Va., July 21, 1922 (R. A. Cushman) and July 2, 1912 (W. Middleton); Harrisburg, Pa., July 4, 1910 (W. S. Fisher); Pyziton, Clay County, Ala. (H. H. Smith).

The Alabama female has the femora entirely fulvous, differing thus from other examples of that sex before me, which have the femora largely blackened.

The specimens which I took at Glen Echo were swept away from the overhanging branches of trees alongside a path in the woods on the north side of the road.

PSEN (PSEN) ERYTHROPODA Rohwer

Psen (Mimesa) erythropoda ROHWER, Proc. Ent. Soc. Washington, vol. 12, p. 182, 1910. (Female.)

One point in connection with the original description of this species is that the abdominal petiole is not included among the portions of the insect that are listed as red in color. Sometimes this is slightly brownish, but it is never black.

Length, 8-14 mm.

Localities: Great Falls, Va. (type); Plummers Island, Md., June 4, 1910 (A. K. Fisher); Glen Echo, Md., June 25 to July 17, 1921 and 1922 (J. R. Malloch); Cabin John, Md., July 31, 1921 (J. R. Malloch); Dauphin, Pa., July 18, 1917 (E. Daecke); Tryon, N.C. (W. F. Fiske).

One specimen listed has mounted with it a spittle-bug (*Aphrophora quadrinotata* Say), which is fully as great in bulk as the wasp. I assume that the wasp intended the bug as provision for its nest, but no data are given on the label as to the circumstances attending their capture.

PSEN (PSEN) MYERSIANA (Rohwer)

Mimesa myersiana ROHWER, Ent. News, vol. 20, p. 324, 1909. (Male and female.)

I have seen only one specimen in addition to the reared series from which this species was described. A feature of this and the other species from North America with the exception of *monticola* is the impressed line behind the posterior ocelli, which extends entirely across to the outer edge of each of the ocelli and connects with a similar line at the center which extends forward to the anterior ocellus. This character does not occur in the genotype, *atra* Fabricius.

Length, 8–10 mm.

Localities: Wetzels Swamp, near Harrisburg, Pa. (P. R. Myers); and Williamsport, Md., May 24, 1915, acc. no. 2888 (J. A. Hyslop).

The type series bears no indication of where the cocoons from which they were reared were obtained, but many parts of Hemiptera, all apparently Homoptera, are attached to the outsides of the cocoons. The specimen from Maryland bears a label with notation: "Prov. nest with *Acutalis calva*" [= *Micrutalis calva* (Say)].

PSEN (PSEN) UNIFASCICULATUS, new species

Male.—Shining black, abdomen glossy, bases of hind tibiae and all tarsi slightly brownish; antennae entirely black; maxillary and labial palpi brownish testaceous; wings hyaline, veins dark. Face densely silvery haired; fasciculate sternal hairs tawny.

Front with large deep contiguous punctures, which become smaller and more compact as they approach the antennal bases, and sparser behind ocelli; central third of clypeus produced downward, transverse at apex. Mesonotum with large deep punctures, which are contiguous and more or less striately arranged on most of the disk; propodeum along the sides of the enclosure rather coarsely rugose, becoming very coarsely so on curve and gradually less so below; mesopleura glossy, moderately coarsely but not contiguously

punctate on disk. Abdominal petiole longer than hind femur, almost rounded, and bare above, carinate on each side below and with a series of fine hairs mesad of each edge. Only the fourth sternite fasciculate, the hairs much shorter and occupying a much smaller proportion of the width of the apex than in the other species except *myersiana*. Hind tibia without dorsal spines. Second cubital cell receiving both recurrent nervures.

Length, 10 mm.

Type.—U.S.N.M. No. 44209, from Beulah, N.Mex., August 8, 1900 (T. D. A. and W. P. Cockerell).

Two male specimens.

MIMUMESA, new subgenus

This subgenus is distinguished from the others by the following group of characters, though it is rarely the case that all of them will apply to one species: A well-defined raised line between the antennal insertions extending from anterior ocellus to below level of antennae and usually at the latter point connected with a small tubercle from which extends on each side a slightly raised line laterally; petiole of abdomen normally very distinctly grooved, one groove on each side of the dorsum, which widen out behind so that the raised central part tapers to a point behind, and the latter is usually more or less noticeably sulcate basally; clypeus sometimes with two central teeth, which are quite closely placed and rounded, rarely with a much smaller tooth on each side of these; the small upper part of the mesopleura (eps 2) glossy, well distinguished from the large lower part by an impressed line (episternaui), and with at most very fine indistinct punctures, never striate or striato-punctate; abdomen usually entirely black, red at base in *clypeatus*.

Below is given a synoptic key to the species available and under each of the old species recorded in the text are given notes on the examination of the types.

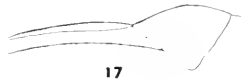
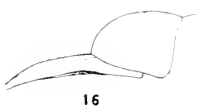
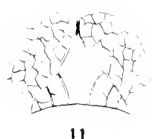
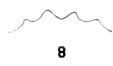
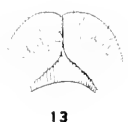
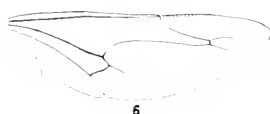
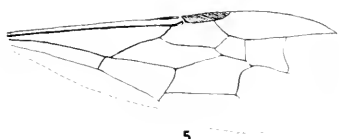
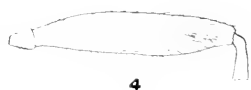
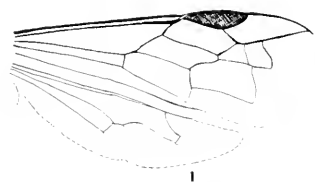
Subgenotype, *Psen niger* Packard.

KEY TO THE SPECIES OF SUBGENUS MIMUMESA

1. Face with dense decumbent golden pile in female, silvery white haired in male; antennal flagellum rufous above and below on a little more than its basal third, black beyond; pygidial area narrow, almost parallel sided, about three times as long as its width at upper extremities of the lateral ridges, surface shining, with a series of large piliferous punctures along each side of basal half; legs black, tibiae and tarsi orange-yellow.

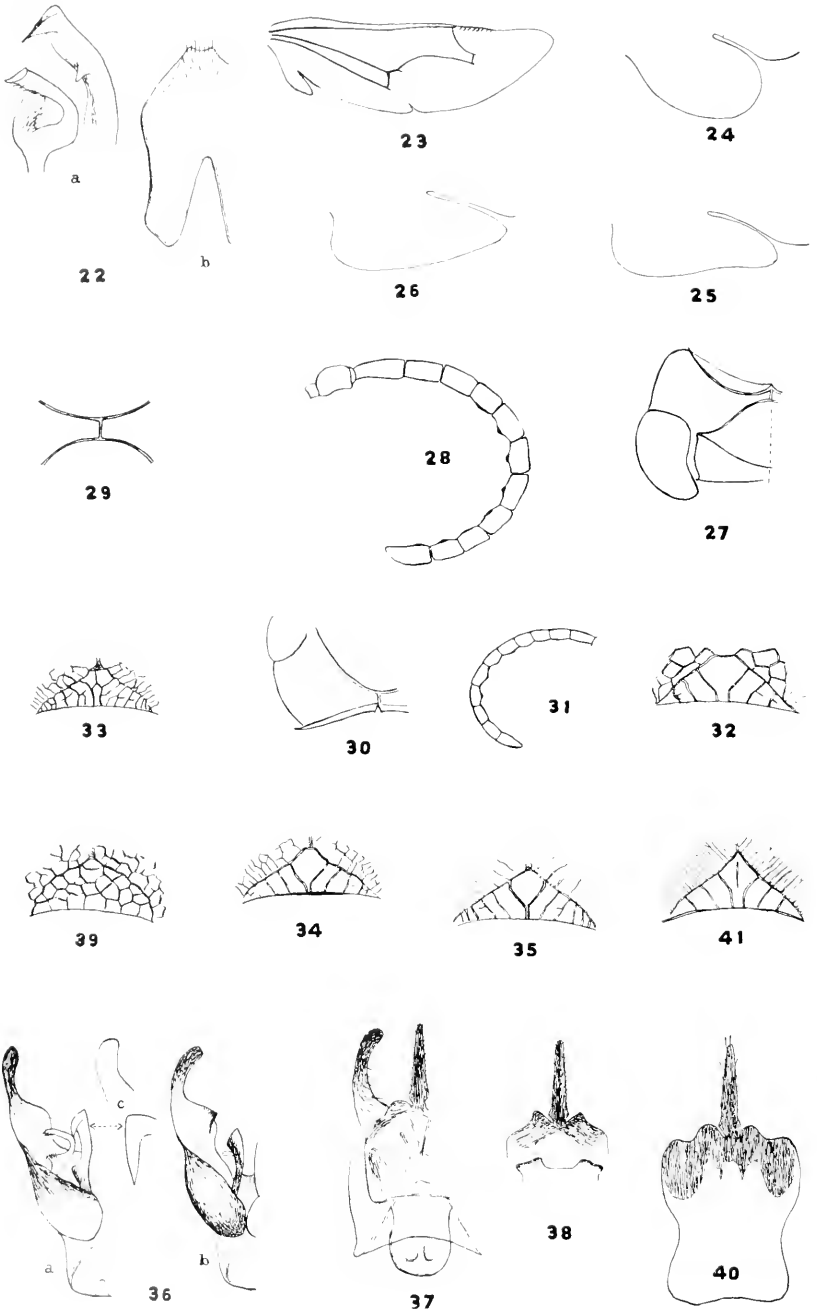
johnsoni (Viereck)

Face with white or silvery pile in both sexes; antennal flagellum not yellow at base and black at apex.----- 2



WASPS OF THE SUBFAMILY PSENINAE

FOR EXPLANATION SEE PAGE 69.



WASPS OF THE SUBFAMILY PSENIINAE.
FOR EXPLANATION SEE PAGE 60.

2. Abdomen red on basal 2 or 3 tergites, the petiole and apex black; occipital carina not connected with the one round mouth margin, evanescent on its inner extremities (pl. 1, fig. 7); tegulae shagreened on their entire surface, less distinctly so on posterior fourth in male, in female with punctures or striae to their apices; clypeus of female with four short teeth, lateral pair very short (pl. 1, fig. 8), teeth in male less distinct; antennal flagellum not noticeably yellowish; pygidium of female broad, with microscopic shagreening and rather dense and quite large piliferous punctures on entire surface, the pile mostly lying close against surface so that sculpture is difficult to distinguish..... *clypeatus* Fox
- Abdomen nowhere red, sometimes some of the tergites brown or yellowish brown at apices; occipital carina connected with the one round mouth margin (pl. 1, fig. 9); tegulae in both sexes with apical half or more glossy and impunctate..... 3
3. Males..... 4
Females..... 13
4. Antennal flagellum testaceous-yellow below, brownish above, segments 2 to 6 with raised line on one side, first 2 with this quite inconspicuous, segments 4 to 6 with the raised part blackish brown and very conspicuous, apical segment black, very strikingly differentiated from preceding segments (pl. 1, fig. 10); head with postocellar region glossy, very sparsely and feebly punctured, without any evidence of striae; mesonotum with moderate-sized punctures and without striae except on posterior margin.
mellipes Say
- Antennal flagellum either entirely dark or, if yellowish below apical segment, not strikingly darker than preceding segments, and raised area on none of segments is as markedly developed as nor strikingly darker than remainder of segments that bear them..... 5
5. Mesonotum striate or punctato-striate on disk..... 6
Mesonotum glossy, and with separated punctures and no striae on disk... 9
6. Mesonotum punctato-striate; petiole of abdomen with central raised part on dorsum consisting of a single rather sharp carina on apical half which is widened out and flattened on basal half or less and has two or more irregular impressed lines on surface which divide it into three quite definitely undulated fine carinae; underside of antennal flagellum reddish yellow on almost its entire extent, the usual raised lines on one side of segments 2 to 10 indistinguishable..... *canadensis*, new species
- Mesonotum definitely striate on most of its disk; petiole of abdomen with dorsocentral carina with a single clean-cut sulcus on practically its entire extent, tapering to a mere line posteriorly and widened anteriorly; antennal flagellum dark, with well-developed raised line or spot on segments 2 to 10 or 2 to 9..... 7
7. A raised line or spot present on flagellar segments 2 to 9; enclosure of propodeum with entire surface reticulated with raised lines, no large central diamond-shaped glossy bare area; tarsi yellowish white, mid pair with fifth segment, hind pair with second to fifth segments, browned on at least upper surface..... *striatus* (Viereck)
- A raised line or spot present on flagellar segments 2 to 10; enclosure of propodeum with a more or less well differentiated central diamond-shaped glossy area..... 8
8. Tarsi yellowish white, mid pair with fifth segment, hind pair with second to fifth segments, browned at least above; vertex behind ocelli laterad of outer ocellus on each side microscopically transversely striate.

longicornis Fox

Tarsi dark brown or fuscous, becoming a little paler apically on fore and mid pairs; vertex nowhere microscopically striate.

bermudensis, new species

9. Petiole of abdomen with dorsocentral carina quite sharp and linear on apical half, flattened on basal half or less and with two irregular impressed lines which divide it into three irregular carinae; antennal flagellum reddish yellow below on almost its entire extent, and without any visible raised line or spot on segments 2 to 10.----- *canadensis*, new species
- Petiole of abdomen with usual central carina sulcate on almost its entire length, the sulcus clean-cut; antennal flagellum usually black, and with some of the segments with a well-developed raised line or spot on one side.----- 10
10. Antennal flagellum with distinctly raised lines present only on seventh and eighth and rarely on sixth segments, underside not noticeably yellow.
- niger* Packard
- Antennal flagellum with several of segments proximad of seventh, with a distinctly raised line on one side.----- 11
11. Head behind ocelli rather closely punctato-striate.----- *mixtus* Fox
- Head behind ocelli without trace of striae.----- 12
12. Raised lines on third to sixth segments of flagellum very narrow, rather sharp, and most of them extending entire length of segment; enclosure of propodeum with ridges high.----- *propinquus* Kincaid
- Raised lines on third to sixth segments of flagellum as wide as those on seventh and eighth, and not extending entire length of segments; enclosure of propodeum with ridges not much elevated.----- *leucopus* Say
13. Mesonotum finely but distinctly longitudinally striate on major portion of its surface; head behind ocelli with very fine transverse striae; petiole of abdomen trisulcate on dorsum; pygidium broader than in *niger* and its allies, with microscopic shagreening, which causes it to appear less glossy than in that group, and with rather large piliferous punctures on most of its extent, though not so broad nor so densely punctured as in *clypeatus*; antennal flagellum not noticeably pale below.----- 14
- Mesonotum not closely and finely longitudinally striate, usually with isolated punctures, rarely more or less striate on posterior margin.----- 15
14. Fore and mid tarsi pale testaceous-yellow, only apical segment of latter browned; mesopleura closely but not very coarsely transversely striate in center (eps 1), anteriorly dull.----- *longicornis* Fox
- Tarsi as in *longicornis*, hind pair with apical three segments brown; mesopleura rather coarsely transversely striate above.----- *striatus* (Viereck)
- All tarsi yellowish on bases and largely infuscated apically; mesopleura glossy on practically its entire extent, anteriorly with a few faint striae but not dull on any part.----- *bermudensis*, new species
15. Antennal flagellum with entire lower side bright testaceous-yellow, pygidium broad, entirely dull because of presence of deep contiguous piliferous punctures; petiole of the abdomen with dorsocentral carina not sulcate except at base.----- 16
- Antennal flagellum entirely dark or very slightly pale below; pygidium narrow and glossy, the punctures rather large and less numerous; petiole of abdomen with dorsocentral carina densely sulcate to or almost to apex.----- 17
16. Clypeus with central produced part transverse; center of mesopleura (eps 1) dull because of closely placed transverse fine striato-punctate sculpturing.
- mellipes* Say

Clypeus with a slight but quite evident central emargination of central produced part; mesopleura entirely glossy, transverse striae on central portion very faint, distinct only on anterior margin.

canadensis, new species

17. Pygidium broad, closely shagreened, and densely piliferous punctate.

propinquus Kincaid

Pygidium narrow and glossy, piliferous punctate sparsely on sides.----- 18

18. Head finely transversely striato-punctate behind ocelli; mesopleura (eps 1) with fine transverse striae, which are faint only on central part of disk.

mixtus Fox

Head either with fine punctures or practically smooth; mesopleura less distinctly sculptured, especially on center of disk.----- 19

19. Face not densely silvery haired, the hairs less closely appressed than usual; enclosure or propodeum with ridges quite high; postscutellum more densely punctured than scutellum.----- *niger* Packard

Face densely covered with appressed silvery hairs; enclosure or propodeum with ridges low; postscutellum not more closely punctured than scutellum.

leucopus Say

PSEN (MIMUMESA) JOHNSONI (Viereck)

Mimesa johnsoni VIIECK, Trans. Amer. Ent. Soc. vol. 27, p. 340, 1901.

? *Psen fuscipes* PACKARD, Proc. Ent. Soc. Philadelphia, vol. 6, p. 402, 1867.

I have some doubt as to the synonymy suggested above, but Mr. Rohwer reports my specimens belong to *johnsoni*, and as there is no specimen of Packard's species in Philadelphia which he could study, the matter is left in doubt, though there is reason to believe the two names apply to the same species.

Fox placed *fuscipes* in the same group as *kohlii* but stated that he did so provisionally, noting that it differed from the four species preceding it in the subtle punctation of the head and dorsulum. The only specimen he had for examination was the broken type specimen and he suggested that the examination of perfect specimens "may show differences requiring the relegation of the species to another group."

The species is the largest of the present segregate, 9-10 mm in length, and the golden pubescence of the face in the female is quite distinctive, no other known to me having the hairs of this color. The pygidium is glossy, with large separated punctures, the petiole of the abdomen has the dorsocentral carina shallowly sulcate to beyond the middle, and the mesonotum is rather variably punctured, sometimes much coarser than one would expect from Fox's note, if the species are synonyms. Antennal flagellum with elevation on one side of all dark segments except eleventh in male.

Originally described from both sexes, the type localities being Riverton, N.J., and Lehigh Gap, Pa. Specimens before me are from the following localities: Middlesex County, N.J., specimen compared with type female by Mr. Rohwer; Riverton, N.J., June 13, 1919 (G. M. Greene); Wetzels Swamp, Harrisburg, Pa., June 21,

1908 (P. R. Myers); Glen Echo, Md., August 10, 1923 (J. R. Malloch); and one male, Takoma Park, Md. (C. N. Ainslie).

PSEN (MIMUMESA) NIGER Packard

PLATE 1, FIGURE 9

Psen niger PACKARD, Proc. Ent. Soc. Philadelphia, vol. 6, p. 399, 1867.

This was selected by Fox as the species for which the group was named, and I am using it as the subgenotype, having both sexes available.

The species is closely allied to the next two, from which it is distinguished by the characters cited in the key.

Fox made use of the rather sparse and quite erect hairing of the face and clypeus in distinguishing this species, *mixtus*, and *leucopus* from their allies, but the character is not a very good one, though in the females of *niger* at least it does occasionally strike one as rather distinctive. The head behind the ocelli is very similarly punctured in *niger* and *leucopus*, the principal distinguishing characters being found in the enclosure of the propodeum.

Length, 6.5–8 mm.

Fox decided that Packard had confused the sexes of two species under *niger*, and he retained as *niger* the species which he considered "best befits the name." The localities cited by Fox are Virginia and Canada, without more definite location. I have before me examples from the following localities: Massachusetts (Baker collection); Long Island, N.Y., and Milwaukee, Wis. (Ashmead collection); Canada, without definite locality (Baker collection); Hanover, N.H., and Sherbrook, Canada (Ashmead collection); and Nerepis, New Brunswick, August 22 (A. G. Leavitt); Tallac Lake, Tahoe, Calif. All are from the collection of the National Museum.

PSEN (MIMUMESA) LEUCOPUS Say

Psen leucopus SAY, Boston Journ. Nat. Hist., vol. 1, p. 370, 1837.

Psen elongatus PACKARD, Proc. Ent. Soc. Philadelphia, vol. 6, p. 400, 1867.
(Male only.)

Very similar to *niger*, distinguishable only as noted above and in the key.

Recorded from Virginia, Illinois, and New Hampshire. Before me there are specimens from the following localities: Washington, D.C., May 23 (C. L. Marlatt); Georgetown, D.C., no date (H. H. Smith); Great Falls, Va., no date (H. H. Smith); and Glen Echo, Md., May 26, 1923, and June 18, 1922 (J. R. Malloch).

A female from Slave Lake, Alberta, Canada, taken on August 14, 1924, by Owen Bryant, has the tarsi darker than the specimen from the United States but does not differ in any other material respect.

The specimens are from the United States National Museum and Bureau of Biological Survey collections.

PSEN (MIMUMESA) MIXTUS Fox

Psen mixtus FOX, Trans. Amer. Ent. Soc., vol. 25, p. 7, 1898.

Psen alticola VIERECK, Trans. Amer. Ent. Soc., vol. 29, p. 66, 1903.

Psen similis ROHWER, Proc. Ent. Soc. Washington, vol. 12, p. 101, 1910.

I have before me a female specimen that was compared by Mr. Rohwer with the types of *mixtus* and *alticola* and found to agree with both, which appears to establish the synonymy as far as these two names are concerned. The synonymy of the third species is based upon a careful examination of the male type of *similis* in the National Museum, and except for the usual sexual differences it appears certain that it is the same as the two just listed. The transverse striation of the upper part of the back of head behind the ocelli is distinctive, but the antennae in the type specimen of *similis* are broken off, the portion of the single flagellum remaining being so badly immersed in the glue with which it is attached to the card that it is not possible to determine the structure of the segments.

Length, 7–8 mm.

Apparently a western species, the recorded localities being Washington State, Moscow, Idaho, Mount Hood, Oreg., and California. The four specimens before me are from the following localities: Florissant, Colo., type male of *similis*; Fort Collins, Colo.; Laggan, Alberta, Canada, June 12, 1928 (O. Bryant); Kaslo, British Columbia, June 13 (R. P. Currie); Canada, no definite locality (Baker collection).

PSEN (MIMUMESA) PROPINQUUS Kincaid

Psen propinquus KINCAID, Proc. Washington Acad. Sci., vol. 2, p. 508, 1900.

This species, of which I have examined the type specimen (no. 5314) in the National Museum, is very similar to *leucopus*, the male being distinguished mainly on the characters cited in the key. The Museum collection contains a female named by Rohwer which is in rather poor condition, the antennae being entirely missing and the face coated with some sort of sticky substance. Fresh material from Alaska that may belong here shows the character of the pygidium cited in the key and suggests the probability that this is the true female of the species.

Length, 8–9 mm.

Type locality, Fox Point, Alaska; female, Port Chester, Alaska (Wickham).

Other localities: Fairbanks and Anchorage, Alaska (J. M. Aldrich).

PSEN (MIMUMESA) MELLIPES Say

PLATE 1, FIGURE 10

Psen mellipes SAY, Boston Journ. Nat. Hist., vol. 1, p. 369, 1837.

This species and the next one are distinguished from the four that have preceded them in this paper by the yellow underside of the antennal flagellum, which is least conspicuous in the male of *canadensis*. The very noticeable distinction between the black apical segment of the flagellum and the preceding segments in the male is a reliable distinguishing character for the species in that sex, and the underside of the flagellum in the female is more broadly yellow than in any other species of the subgenus except *johnsoni*, but in the latter the yellow color is confined to the basal half of the flagellum. The tibiae in the female are not entirely yellow, even the fore pair being sometimes partly darkened, and the hind pair are usually mostly black. The peculiar swellings of the intermediate segments of the antennal flagellum in the male readily distinguish the species from *canadensis*, and the most distinctly elevated of these are much darker than the remainder of the segments upon which they are situated.

Length, 6–7.5 mm.

Originally described from Indiana, and recorded from New York by Fox. I have before me specimens from the following localities: Columbus, Ohio, July 15, 1921 (A. E. Miller); Ames, Iowa, July 15, 1926, and August 4, 1927 (G. O. Hendrickson); 8 miles southeast of Britt, Iowa, August 9, 1928 (G. O. Hendrickson); Funkstown, Md., August 3, 1916, Cage 832 (P. R. Myers); Anacostia, D.C., August 9, 1914 (W. D. Appel).

PSEN (MIMUMESA) CANADENSIS, new species

Male and female.—Similar in general characters to *mellipes*, distinguished in the male by the color and structure of the antennal flagellum and in the female by the slight but distinct emargination of the central production of the clypeus, and the much darker tibiae, which are usually all black. Both species have the petiole of the abdomen with the central carina rather poorly developed and the basal half of it with 2 or 3 irregular impressed lines, which are largely waved.

The pygidium in the females of both species is much broader than in the *niger* group, being similar to that of *clypeatus*, the surface covered with quite deep and closely placed piliferous punctures, so that it appears entirely dull. This last is generally considered as a group character, but other features appear to link the two species with the present subgenus despite the lack of a well-defined

sulcate dorsocentral carina on the abdominal petiole. The carina between the antennae is complete, and the section of the mesopleura above the episternauli is glossy and without definite sculpture, while the episternauli is well developed.

Length, 6.5–7.5 mm.

Type (U.S.N.M. No. 44210), male (no. 2416); allotype (no. 2021), and five paratypes, from Canada, without more definite locality (C. F. Baker collection).

PSEN (MIMUMESA) STRIATUS (Viereck)

Mimesa striatus VIERECK, Trans. Amer. Ent. Soc., vol. 27, p. 339, 1901.

This species and the two dealt with subsequent to it in this subgenus are distinguished from their allies by the presence of longitudinal closely placed fine striae on the greater portion of the mesonotum. I have segregated the three upon rather minute characters but believe they are distinct, the present one being accepted as the one described by Viereck because it fits the description better than either of the other two. Viereck, however, apparently had at least one specimen of *longicornis* before him, as he stated in a paragraph under the description that he had seen a specimen labeled Florida, which, judging from the description, ought to have been *longicornis* instead of *striatus*.

I have seen one damaged female of *striatus*, from Cape May, N.J., the single male before me being from Chesapeake Beach, Md., July 2, 1924 (J. R. Malloch).

PSEN (MIMUMESA) LONGICORNIS Fox

Psen longicornis Fox, Trans. Amer. Ent. Soc., vol. 25, p. 8, 1898.

Psen floridana ROHWER, Proc. Ent. Soc. Washington, vol. 12, p. 102, 1910.

This species is very similar to *striatus* as accepted above, differing mainly as indicated in the key. Fox's type was from Florida, and apparently like the type of *floridana* Rohwer, and a male bearing the name *albitarsis* Ashmead in the National Museum; all three were taken in that State by Mrs. A. T. Slosson. Ashmead did not apparently describe his species, and the female type of *floridana* bore also a manuscript name, *floridana*, by that authority when it was described by Rohwer.

I place with the above two three females, from Alexandria, La., May 22, 1908 (F. C. Bishopp); 10 miles southwest of Kelso, Iowa, July 30, 1928, and Yemassee, S.C., September 30, 1926, that agree in every respect with the one standing as *floridana*.

This is apparently a southern species.

PSEN (MIMUMESA) BERMUDENSIS, new species

Male and female.—Similar in structure and general coloration to *longicornis* and *striatus*, differing essentially only as indicated in the key. The pygidium of this and the next species above is shining, almost without shagreening, broader than in the *niger* group but not so broad as in *canadensis*, and has numerous large piliferous punctures, which are rather more dense along the sides than in *niger*, but not so much segregated into lateral series as in that species. The petiole of the abdomen is very similar in all three species, with a dorsocentral carina which is sulcate on practically its entire length, the length of the petiole being at least equal to that of the hind trochanter and femur combined.

Length, 7–8 mm.

Type (U.S.N.M. No. 44211), male, allotype, and three male paratypes, from Bermuda, West Indies, May 3, 1909 (F. M. Jones); 2 female and 1 male paratype, Spanish Point, Bermuda, July 5, 1910 (R. Spalth).

PSEN (MIMUMESA) CLYPEATUS Fox

PLATE 1, FIGURES 7, 8

Psen clypeatus Fox, Trans. Amer. Ent. Soc., vol. 25, p. 15, 1898.

A rather aberrant species in this subgenus, being the only one in which there is any distinct red color on the abdomen, and having the pygidium of the female similar to that of *canadensis*.

The head behind the ocelli is microscopically transversely punctato-striate, the mesonotum has a large part of the disk with rather deep punctures, which are in part situated in slight striae, and the petiole of the abdomen has a distinct tapered dorsocentral carina, which is shallowly sulcate. The female has the pygidium of the same form as in *canadensis*, which incidentally is the typical form in the next subgenus. The petiole is about as long as the hind femur.

Length, 6–7.5 mm.

Originally described from Nevada and Colorado. Before me there are specimens from the following localities: Colorado, compared with type by Rohwer; mouth of Bear River, Utah; Redlands, Calif.; and California without other data. One female taken from the stomach of a toad from California shows the two submedian apical teeth of the clypeus more distinctly than usual.

A remarkable specimen in which the petiole of the abdomen is very short, flat above, with divergent striae on that surface, and widened apically, is apparently an abnormality, as there is a rather deep impression on the first tergite, which indicates that some injury has affected it in the pupal stage. This specimen is from the mouth of Bear River, Utah (Wetmore).

In addition to the above material, I have seen two specimens from Idaho, one taken at Twin Falls, and the other at Castleford, in connection with the beet insect investigations.

PSEN (MIMUMESA?) CHALCIFRONS Packard

Psen chalcifrons PACKARD, Proc. Ent. Soc. Philadelphia, vol. 6, p. 401, 1867.

I have not seen this species, which was described from a single female specimen from Illinois. It appears to me highly probable that it is the same as *striatus*; it at least is very closely similar to it. The description of the color of the legs in almost every respect agrees with that of *longicornis*, but without access to the type it is impossible to decide the exact status of the species.

Mr. Rohwer has examined the type specimen and reports that it belongs to the same group as *ressoni*, in which case it is very close to *nigrescens* Rohwer, which see.

PSEN (MIMUMESA) MODESTUS Rohwer

PLATE 1, FIGURE 11

Psen (Mimesa) modesta ROHWER, Proc.U.S.Nat.Mus., vol. 49, p. 244, 1915.
(Female.)

This species, described from the female, is represented by three specimens in the National Museum collection and a careful examination of these discloses the fact that it belongs to this subgenus, and to the group in which the mesonotum is distinctly longitudinally striate. In my key above it will run down to "7." From all three species of the group it differs in having the dorsocentral carina of the petiole with a longitudinal sulcus on only the basal half or less of its extent. The antennal flagellum is black, with a quite evident raised shining line on one side of segments 2 to 8, and rarely a much less evident short shining elevation on segment 9. The enclosure of the propodeum has the central glossy diamond-shaped depression (pl. 1, fig. 11) that is typical of *longicornis* and *bermudensis* and which distinguishes it from *striatus* as accepted herein.

I believe the species is distinct from the other three with which the striate mesonotum links it but do not include it in my key because it is not North American.

Length, 7 mm.

Type.—U.S.N.M. No. 15081, from Mayaguez, Puerto Rico.

A male specimen in the National Museum from Trinidad agrees in every particular with the type material, even to the large glossy central diamond-shaped part of the propodeal enclosure, the only difference being that the antennal flagellum is not so dark, the general color dark brown or fuscous and not noticeably yellow below.

Locality.—Caroni River, Trinidad, October 12, 1916, A. 757 (H. Morrison).

PSEN (MIMUMESA) MODESTUS RETICULATUS, new variety

PLATE I, FIGURE 12

Male.—Differs from the above in having the antennae brownish yellow below on almost the entire flagellum, and the propodeum with almost the entire surface rugoso-reticulate (pl. 1, fig. 12).

Type.—U.S.N.M. No. 44231, from Caroni River, Trinidad, October 12, 1916, A. 757 (H. Morrison).

PSEN (MIMUMESA) COLORADOENSIS Cameron

Psen coloradoensis CAMERON, Trans. Amer. Ent. Soc., vol. 34, p. 232, 1908. (Female.)

It appears to me certain that this species, the exact identity of which I am unable to arrive at, belongs to this subgenus, as the describer stated that it would fall in Fox's group 2, and runs near *cylindricus* and *regularis*.

Judging from the description, it falls in the same group with *niger*, *mixtus*, and *leucopus*, with a possibility that it may be the second species.

Locality.—Berkeley County, Colo. (= Berkeley, Calif.?).

PSEN (MIMUMESA) INTERSTITIALIS Cameron

Psen interstitialis CAMERON, Trans. Amer. Ent. Soc., vol. 34, p. 233, 1908. (Male.)

Cameron rejected the idea that this might be the male of *coloradoensis* owing to the interstitial second recurrent and cubital nerves, the lack of a distinct frontal keel, and the shorter abdominal petiole.

As there is a great deal of variation in the positions of the cubital and the recurrent nervures, I am not inclined to consider the character of importance in the distinction of species. The lack of a frontal keel would appear to suggest that the species does not belong to this subgenus, but the observation may not have been accurate, and there is some variation in the length of the abdominal petiole in many species of the subfamily, especially in the sexes of certain species. It is impossible to decide what this species really is without examination of the type.

Locality.—New Mexico, no definite location.

The types of both the above species were in the Cameron collection, which is, I believe, in the British Museum of Natural History in London.

Subgenus MIMESA Shuckard

Reference as under genus, p. 6.

The two characters which can be depended upon invariably for the separation of members of this subgenus from the *Mimumesa* are the

lack of a complete carina from the anterior ocellus to below the level of the antennal insertions between the antennae and the presence of distinct sculpture on the upper portion of the mesopleura (eps 2), the latter being but indistinctly separated from the lower part (eps 1) by an impressed line (episternauli). Usually the petiole of the abdomen is rounded above, without lateromarginal sulci, and the female has the pygidium broader and more closely punctate than in typical members of the preceding group, though several of the species of the latter have similarly formed pygidia. Most of the species have the base of the abdomen red, but some are without this characteristic.

KEY TO THE SPECIES OF SUBGENUS MIMESA

- | | |
|---|-----------------------------|
| 1. Males ----- | 2 |
| Females ----- | 17 |
| 2. Abdomen red on first and second tergites beyond petiole.----- | 3 |
| Abdomen not distinctly red at base, sometimes with apices of tergites
yellowish brown, or testaceous.----- | 26 |
| 3. Segments 2 to 5 of antennal flagellum each with an angular elevation on
one side, the highest point of which is at middle of segment, most evident
when segment is viewed crosswise, flagellum distinctly thickened to apex
and bright fulvous-yellow on entire underside; hind coxae with a sharp
carina on almost the entire inner side; propodeum (pl. 1, fig. 13) with
enclosure not very well marked, furnished with fine striae that diverge
slightly on each side, adjacent portions with much finer and more closely
placed striae that are sometimes almost obliterated on apical curve on
each side; petiole rarely less than length of femur and trochanter com-
bined, rounded above, with a fine carina on each side of ventral surface,
and above the carina a slight sulcus on each side.---- cressoni (Packard) | |
| Antennal flagellum with much less evident, or no, elevations on second to
fifth segments, rarely as conspicuously yellow below or as distinctly
thickened apically, and when almost so then without evident elevation;
hind coxae with at most a short carina on basal half or less of inner
side, usually merely rounded; petiole of abdomen in species with flagellar
elevations not so long as hind femur; propodeum either with coarser
sculpture or if almost similar then hind coxal carinae are lacking.---- | 4 |
| 4. Legs and antennae entirely testaceous-yellow.----- | cingulatus (Packard) |
| Legs and antennae at least partly black or very dark brown.----- | 5 |
| 5. Upper part of mesopleura (eps 2) so closely and finely punctured that it
appears to be granulose and without a distinct gloss; lower part (eps 1)
densely shagreened and dull, with moderate-sized close punctures; flagel-
lar segments 2 to 5 or 6 slightly and evenly rounded when seen in profile,
the highest point at or close to the middle of each; propodeum with areas
laterad of enclosure finely striate, surface granular so that striae are
almost invisible except under a very high magnification, sculpture becom-
ing reticulate at curve; petiole subequal in length to remainder of first
segment.----- | proximus (Cresson) |
| Upper part of mesopleura (eps 2) longitudinally striate or striato-punctate,
sometimes finely so, and like the lower part (eps 1) generally more or
less conspicuously shining; other characters not as above in their
entirety.----- | 6 |

6. Propodeum with areas immediately laterad of enclosure broadly smooth and glossy, the smooth part extending to, or almost to, curve; antennal flagellum yellow, narrowly browned above, clubbed much as in *ressoni*, but with no evident sensory elevations on any of the segments; cps 2 with very fine and irregular longitudinal striae, which are most noticeable posteriorly, surface shining but obscured by dense closely appressed silvery white hairs.....**politus**, new species
Propodeum with quite distinguishable sculpture immediately laterad of enclosure..... 7
7. Antennal flagellum with not more than apical six segments bright orange-yellow below..... 8
Antennal flagellum bright orange-yellow on entire length of underside or with only basal segment blackened below..... 9
8. Petiole of abdomen flattened above, sometimes shallowly grooved along median line; basal segments of flagellum hardly longer than second, sensory areas very broad, slightly shining, and not sharply differentiated from remainder of segments 2 to 7; clypeus with a quite deep V-shaped central notch.....**basirufus** (Packard)
Petiole of abdomen convex above, with a slight depressed line along each lateral edge; basal segment of flagellum about 1.33 as long as second, sensory areas almost linear, not extending entire length of segment and quite sharply elevated and differentiated; clypeus with a rather shallow rounded central emargination.....**unicinctus** (Cresson)
9. Large species, not less than 10 mm in length; male with a slight but evident raised line on each side of disk of apical tergite on its apical fourth or less which simulate the pygidial lateral carinae of female (pl. 1, fig. 14); antennal flagellum clubbed at apex, basal segment about 1.5 as long as second, preapical segment not so long as wide, and no segment with distinct raised sensory area.....**pygidialis**, new species
Smaller species, not more than 8 mm in length; apical tergite without raised lines..... 10
10. Pronotum with a spikelike production of each lateral angle; hind coxae rather sharply carinate on at least the basal half or their inner or opposed surfaces; petiole distinctly longer than swollen part of first segment; apex of first, all of second, and at least the basal half of third tergite red..... 11
Pronotum rounded or merely angulate on each lateral angle..... 13
11. Interocellar region with closely placed punctures, whole width of front behind ocelli finely transversely striate and with similar punctures to those on interocellar region, the part immediately behind space between posterior ocelli as densely punctured as remainder and not at all tumid; mesonotum with no trace of shagreening on disk except faintly in front.....**punctifrons**, new species
Interocellar region not evenly punctured, the region behind it quite markedly tumid, and surface not transversely striate; mesonotum with very distinct shagreening..... 12
12. Fore and mid tibiae fulvous-yellow; dorsolateral sulci of petiole undeveloped..... **edentatus**, new species
Fore and mid tibiae largely dark brown; dorsolateral sulci of petiole distinct..... **impressifrons**, new species
13. First, second, and third tergites of abdomen entirely red; propodeum finely rugoso-reticulate, enclosure appearing granulose except under a very high power lens (pl. 1, fig. 15); petiole a little shorter than swollen part of

first segment, the latter more abruptly elevated in front than usual (pl. 1, fig. 16); flagellum slightly clubbed, penultimate segment longer than thick----- *arizonensis*, new species

At least a part of first tergite black or dark brown; propodeum rarely as finely sculptured, at least in enclosure; first tergite not so abruptly elevated in front----- 14

14. Petiole of abdomen almost, or quite, as long as hind femur and not less than 1.5 as long as swollen part of first segment when viewed from above (pl. 1, fig. 17); propodeum rugoso-reticulate alongside enclosure_ 15

Petiole of abdomen shorter than hind femur and not noticeably longer than swollen part of first segment when viewed from above (pl. 1, fig. 18)-- 16

15. Antennal flagellum noticeably longer than head and thorax, not much swollen apically, penultimate segment distinctly longer than thick, with a rather sharp linear elevation on one side of each segment from second to fifth inclusive, which lies within margin of black part; head behind ocelli with microscopic transverse striae; petiole narrowly slightly and evenly convex on entire dorsal surface and without a sulcus close to each laterodorsal edge----- *argentifrons* (Cresson)

Antennal flagellum shorter, more definitely swollen apically, penultimate segment about as thick as long, with a broader and less evidently elevated area on each segment from second to fourth, less obvious on fifth, which is paler in color and lies on edge of yellow part; head behind ocelli without transverse striae; petiole narrowly convex on middle line and with a shallow piliferous sulcus along each laterodorsal edge----- *borealis* (Smith)

16. Propodeum finely sculptured, areas laterad of enclosure with numerous fine striae, enclosure finely rugoso-reticulate much as in *arizonensis*.
gregarius Fox

Propodeum coarsely rugoso-reticulate, areas laterad of enclosure with much coarser striae, sometimes reticulate almost up to edge of enclosure.
pauper (Packard)

17. Abdomen entirely without red basal markings, apices of some of tergites more or less evidently brownish yellow----- *maculipes* Fox

Abdomen with at least a part of second tergite distinctly red on disk---- 18

18. Abdomen with only petiole of first segment black, swollen part of tergite, and at least second and third tergites red----- 19

Abdomen with petiole and at least a large part of swollen part of segment black ----- 22

19. Propodeum with areas contiguous to enclosure broadly glossy and without a trace of sculpture----- *politus*, new species

Propodeum always with more or less definite sculpture on areas laterad of enclosure, sometimes rather fine contiguous to it----- 20

20. Propodeum finely longitudinally striate, enclosure a little more coarsely so than contiguous areas, latter in exceptional cases almost without striae close to edges of enclosure and becoming progressively more evidently striate toward lateral curves and over latter; hind coxae with a distinct fine carinate line on inner or opposed sides; petiole of abdomen slender, usually at least as long as hind femur, slightly widened at apex, where it is about one sixth as wide as its length, convex and not sharply margined on each side above, the laterodorsal sulci practically lacking; face not wider at lower edge of the antennal insertions than long in center; petiole black to apex below----- *cressoni* (Packard)

- Propodeum rugoso-reticulate, definitely longitudinally striate basally in enclosure and immediately against it for a short distance outwardly; hind coxae not distinctly carinate on inner sides; petiole of abdomen rather thick, laterodorsal edges sharp, sides slightly hollowed out and lateroventral edge quite sharp; face fully as wide at lower edge of antennal insertions as long in center; apex of petiole red below----- 21
21. Petiole with a quite evident broad carina or central longitudinal convexity on its entire dorsal length; basal segment of antennal flagellum almost as long as next two segments combined----- *pygidialis*, new species
Petiole flat, or almost so, on dorsum; basal segment of antennal flagellum distinctly shorter than next two combined----- *basirufus* (Packard)
22. Upper portion of mesopleura (eps 2) closely granular or reticulate, very minutely striate posteriorly, appearing entirely dull; a portion of first, all of second and third, and all or most of fourth tergite red; petiole of abdomen about half as long as hind femur; clypeus as in plate 1, figure 19, without preapical elevation----- *proximus* (Cresson)
Upper portion of mesopleura (eps 2) more or less glossy, longitudinally striate or rugoso-reticulate; if feebly sculptured the other characters are not as above----- 23
23. Clypeus with a rather prominent small elevation in center near apical margin, the latter as in plate 1, figure 20, in structure; eps 2 shining and almost without sculpture; propodeum with fine striae, which extend from base of enclosure divergently on each side to lateral curves; apex of first tergite, all of second and third, red---- *coquilletti* Rohwer (= *granulosus* Fox?)
Clypeus not as above in structure, if with a preapical elevation it is not so high, and much longer, and apical margin is not as figured; eps 2 with well-developed sculpture, generally rather strongly longitudinally striate----- 24
24. Small species, averaging about 7 mm in length, with only apex of first and all of second tergite red; propodeum rather coarsely sculptured, enclosure with rather large rugose reticulations----- *pauper* (Packard)
Larger species, averaging 8 mm or more in length, with apex of first, all of second, and all, or a large part of, third tergite red----- 25
25. Propodeum finely sculptured, lateral areas contiguous to enclosure very finely striate----- *unicinctus* (Cresson)
Propodeum more coarsely sculptured, lateral areas contiguous to enclosure rugoso-reticulate almost up to edge of latter----- *borealis* (Smith)
26. Sternites 1 to 3 beyond petiole subequal in length, all more than twice as long on their median line as wide at base; pronotum entirely rounded at lateral angles; enclosure of propodeum with small fine rugose reticulations, contiguous lateral areas finely rugose, becoming reticulate at downward curve; wings whitish hyaline----- *granulosus* Fox
Sternites not as above, 1 much longer than either 2 or 3, the last mentioned two not nearly twice as long on median line as their width at base; pronotum with well-developed lateral angles; propodeum not as above; wings grayish or brownish hyaline----- 27
27. Flagellar segments 2 to 5 or 6 each with a papillalike elevation on one side close to middle; enclosure of propodeum with fine parallel longitudinal striae, contiguous lateral areas with similar but finer and divergent striae that become coarser toward downward curves; petiole of abdomen fully as long as hind femur, slender and evenly convex above; width of face at lower edge of antennal insertions not so great as length from there to apex of clypeus in center----- *cressoni* (Packard)

Flagellar segments 2 to 6 each with a slight linear elevation on one side extending almost entire length of segment, which is but faintly visible in profile ($\times 34$); propodeum much more coarsely sculptured, rugoso-reticulate on at least the areas adjacent to enclosure; petiole of abdomen rather thick and not nearly so long as hind femur; face at lower level of antennal insertions a little wider than its length in center----- maculipes Fox

PSEN (MIMESA) CRESSONI (Packard)

PLATE 1, FIGURES 13, 21

Mimesa cressoni PACKARD, Proc. Ent. Soc. Philadelphia, vol. 6, p. 405, 1867. (Female.)

Mimesa denticulata PACKARD, Idem, p. 406. (Male.)

Psen cressoni Fox, Trans. Amer. Ent. Soc., vol. 25, p. 12, 1898. (Male and female.)

This species is very readily distinguished from its allies by the characters given in the key. The broadly yellowish testaceous under side of the antennal flagellum in both sexes, with the distinct clubbing, and the subangular median elevation on one side of the second to fifth or sixth segments in the male, the very fine divergent striae of the propodeum, particularly on the curve outside of the enclosure, the long dorsally rounded parallel-sided petiole, and the sharply carinate line on the inner side of each hind coxa combine to separate it from any other species of the subgenus. The entire sides of the propodeum are almost smooth, at most granulose, and the width of the face at lower level of the antennal insertions is not so great as its length from there to the lower level of the center of clypeus. This last character is distinctive, all the other species having the width of the face at lower level of the antennal insertions about equal to the central length. The head is also higher as compared with its width in *cressoni* than in any other species, the two being about equal, while in other species the width generally exceeds the height. Hypopygium of male as in plate 1, figure 21.

Length, 6–8.5 mm.

Recorded from the following States: New Jersey, Delaware, Illinois, Colorado, and Montana. Represented in material before from Washington, D.C.; Falls Church, Va.; Beltsville, Md.; and from Kansas, Nebraska, Iowa, Indiana, Washington, Idaho, Alabama, New Hampshire, and Missouri. A series of rather small specimens from Canada in the Baker collection.

PSEN (MIMESA) CRESSONI ATRIVENTRIS, new variety

This variety differs from the typical one in having the abdomen black, with a slight reddish tinge on sides of the second segment.

Type.—U.S.N.M. No. 44212, from Canada, no other data (no. 2068, Baker collection).

PSEN (MIMESA) UNICINCTUS (Cresson)

Mimesa unicinctus CRESSON, Proc. Ent. Soc. Philadelphia, vol. 4, p. 488, 1865.
(Male, not female.)

This species shows a sexual color dimorphism, the male having only the apex of the first tergite and all of the second red, while the female has in addition the greater portion of the third also red. The antennal flagellum of the males has only the apical 5 or 6 segments distinctly yellow below, the pale color fading out about the middle, in which character it closely resembles the male of *basirufus*. The petiole of the abdomen is, however, narrower and slightly longer than in that species and is distinctly convex above and without a sharp lateroventral edge so that the side is not distinctly sulcate. The sculpture of the propodeum is also less coarse, the areas adjacent to the enclosure being rather finely striate and almost without reticulations.

Length, 6–8 mm.

The species was originally described from Colorado, and all the specimens now available to me, including both sexes, are from that State.

PSEN (MIMESA) BASIRUFUS (Packard)

Mimesa basirufa PACKARD, Proc. Ent. Soc. Philadelphia, vol. 6, p. 406, 1867.
(Female.)

? *Mimesa nebrascensis* SMITH, Univ. Nebraska Studies, no. 8, p. 390, 1908.

This species, as already noted, is very similar in the male sex to *unicinctus*, but the female is more readily distinguished on the basis of the apically widened and dorsally flattened petiole of the abdomen, which is usually depressed in center above and occasionally has a slight central sulcus or channel on almost the entire length. In the only female of *unicinctus* I have seen the first tergite of the abdomen is broadly blackened on disk, while in all the females of *basirufus* I have, this tergite is entirely red, as is also the extreme apex of the petiole below.

Length, 7–9 mm.

Described from Maine and subsequently recorded from Washington, Oregon, Nevada, Arizona, Colorado, Montana, and British Columbia. I have seen it from Maine, New Mexico, South Dakota, Colorado, and British Columbia.

PSEN (MIMESA) PROXIMUS (Cresson)

PLATE 1, FIGURE 19

Mimesa proxima CRESSON, Proc. Ent. Soc. Philadelphia, vol. 4, p. 488, 1865.
(Female.)

This species is another in which the petiole of the abdomen is much shorter than the hind femur. The dorsal surface of the petiole has

a distinct central convex area on its entire extent which is variable in width, but there is always a sulcus close to the lateral edge on each side in which there are numerous fine short hairs; the length of the petiole in the female is hardly more than half that of the hind femur, while in the male it is about two thirds as long as the femur and slenderer than in the female, the general structure being similar to that of *unicinctus*, the lateroventral edge almost rounded. A very striking character of the species is the finely undulate striate sculpture of the upper portion of the mesopleura (eps 2), which causes it to appear dull in both sexes, the two preceding species having the sculpture coarser, consisting of almost straight longitudinal striae and the surface is distinctly shining. The propodeum has the enclosure very poorly outlined, with almost straight fine striae, which are somewhat reticulated centrally at apex, and the adjacent areas outside of the enclosure are finely longitudinally striate, very much as in *ressoni* though a little more noticeably reticulate at the lateral curve. The male has the antennal flagellum more clubbed than in *unicinctus*, pale on the entire underside, and the second to sixth segments are raised on one side, though evenly and roundly so, with the highest point at middle. The female has the apex of the first tergite, all of second and third, and all or most of fourth red, but the male has only the apex of first and all of second and third red.

Length, 6.5–8 mm.

Described from Colorado and since recorded from Nebraska. The material before me is from Colorado and Springer, N.Mex.

I know of no previous record of the recognition of the male of the species.

PSEN (MIMESA) GRANULOSUS Fox

Psen granulatus Fox, Trans. Amer. Ent. Soc., vol. 25, p. 15, 1898.

This is one of the most readily recognizable of the species described by Fox, the entire black abdomen of the male being of a peculiar elongate form with the apex pointed and the anterior margin of the two sternites immediately beyond the petiole much narrower than usual, that of the second being not more than one third as wide as its length at center. The petiole is subequal in length to the dilated part of the first tergite, convex above and with a shallow piliferous sulcus along each side, the lateroventral edges sharp, subcarinate, and the sides shallowly sulcate. The front of the head is closely covered with small deep punctures, the face below the antennal insertions is about as wide as its length in center, the clypeus has a slight central notch, the mandibles are almost entirely black, the antennal flagellum is testaceous-yellow, narrowly dark brown above, distinctly clubbed at apex, the penultimate and antepenultimate segments not so long on their lower edge as they are thick, and the basal segments without

evident raised line on one side. The propodeum under a moderate magnification ($\times 20$) appears granulose and dull, under a high magnification ($\times 32$) the enclosure is seen to be covered with small reticulations or rugae, while the adjacent areas outside of it are more striate, becoming reticulate near the downward curve. Pronotum very broadly rounded on each side, practically without the usual lateral angle. Upper mesopleura (eps 2) granulose. Legs black, the bases and apices of all tibiae and most of the fore and mid tarsi brownish yellow. Wings more noticeably whitish hyaline than in any other species, the costal vein up to the stigma yellow, the other veins black. Hind coxae sharply carinate on inner side.

Length, 7.5 mm.

Originally described from Montana. The male before me is from Tuttle, Idaho, July 1, 1930, no. 9, *S. pestifer*.

PSEN (MIMESA) COQUILLETTI Rohwer

PLATE 1, FIGURE 20

Psen (Mimesa) coquilletti ROHWER, Proc. Ent. Soc. Washington, vol. 12, p. 103, 1910. (Female.)

Female.—Similar to *granulosus*, of which I am practically certain it will prove to be the female. Legs almost entirely black, the hind pair entirely so, with white hairs, spines, and spurs. Abdomen with the extreme apex of first and all of second and third tergites red. Wings white, the costal vein much paler than the radius.

Structurally similar to *granulosus*, differing strikingly in the structure of the clypeus, the anterior aspect of which is shown in plate 1, figure 20. That there should be a very prominent elevation near the anterior margin in center which is not evident in the male is a normal feature of the sexual dimorphism of the subgenus, though in this species the elevation is much more prominently developed than in any other species now before me, and the submedian teeth are also better developed. The other structures are very similar to those of the foregoing male, except that the petiole is rather shorter and the sternites are of the usual width on anterior margin.

Length, 8 mm.

Originally described from a female taken in San Diego County, Calif. I have a female that agrees in all details with the type from Glendale, Nev., October 3, 1929, on *Chrysothamnus paniculatus*, no. 1119, B-29 (David E. Fox).

The male which the describer associated with the type does not, I am sure, belong here, as the upper mesopleura (eps 2) is finely but distinctly longitudinally striate instead of merely alutaceous and slightly punctured, as in the female and in *granulosus*. In all three the hind coxae are rather distinctly carinate on their inner surfaces.

The wings in the males placed with the type of *coquilletti* are not white but yellowish hyaline, and the costal vein is not paler than the radial vein except at extreme base.

I leave these male specimens without a definite name but consider that they belong to a species unknown to me in the female sex.

Locality, Los Angeles County, Calif. (Coquillett).

PSEN (MIMESA) POLITUS, new species

Male and female.—Shining black, underside of antennal flagellum broadly yellow, facial hairs silvery white, the pleura so densely covered with short silvery hairs that they practically obscure the sculpture on most of the upper portions of the mesopleura; abdomen in male with apex of first, all of second, and anterior half or more of third tergite red, that of female with all of first to third tergites red; coxae, femora, and apical two thirds of hind tibiae blackened, remainder fulvous-yellow; wings whitish hyaline, veins and stigma fuscous, base of latter and most of costal vein up to stigma yellowish.

Male.—Slender, the abdomen about 1.5 as long as head and thorax combined. Antennal flagellum distinctly clubbed, penultimate and antepenultimate segments about as thick as long, no segments with distinct sensory elevations; front glossy, with small isolated punctures; ocelli quite large, the distance between the hind pair greater than that of either from eye; interantennal elevation slight, without an upwardly continued ridge; clypeus with a small, moderately deep rounded central excision in anterior margin; head broader than high. Mesonotum and scutellum glossy, with rather small deep isolated punctures; mesopleura glossy, eps 2 with very fine and rather irregular longitudinal striae; propodeum with the enclosure poorly differentiated, the sculpture consisting of fine longitudinal striae which are eliminated just beyond the margin of the enclosure so that there is a rather large bare, slightly alutaceous area on each side that extends almost to the curve, where the striae begin again but so faintly that the posterior face appears to be merely granulose. Petiole a little shorter than hind femur and about 1.5 as long as the swollen part of the first segment, longitudinally convex above and with the laterodorsal carina very poorly developed, the lateroventral one only partially present. Legs and wings normal, second cubital cell little narrowed above.

Female.—Differs from the male as usual in having the puncturation of the front much weaker, almost lacking, and the clypeus with the anterior margin rounded, the preapical elevation quite small and prominent. This last feature is usually a female character, as it is in this species, but more generally the elevation is more transverse, forming a slightly raised and rather poorly margined ridge that extends across about one third of the width of the clypeus.

Propodeum with the areas laterad of the enclosure even more shiny than in the male because of the lack of shagreening. Pygidium about twice as long as wide.

Length, 9 mm.

Type.—U.S.N.M. No. 44213, male, one half mile west of Thoreau, N. Mex., July 24, 1929, on *Salsola pestifer*, lot 5823, no collector's name; allotype, Meadow Grove, Nebr., July 18, 1929 (C. N. Ainslie).

This is the only species of the genus known to me in which the propodeum is entirely without definite sculpture on the areas contiguous with the enclosure.

PSEN (MIMESA) ARIZONENSIS, new species

PLATE 1. FIGURES 15, 16

Male.—Readily distinguishable from most of its allies by the entirely red first, second, and third abdominal tergites. The antennal flagellum is brown above and broadly yellow below, the scape is black, and the hairs of the face are silvery white. The coxae and femora are black, the tibiae dull yellow and broadly browned apically, and the hind tarsi are dull brownish yellow, with the apices of the segments paler. Stigma dark brown, paler at extreme base.

Flagellum but slightly thickened apically, the penultimate segment longer than thick, none of the segments with well-developed elevations; clypeus slightly produced centrally and with a very narrow median notch; front quite closely punctured and with fine shagreening, a slight impressed line across behind the posterior ocelli. Mesonotum with moderate punctures and slightly alutaceous, the scutellum more shining and sparsely punctured; propodeum with the enclosure poorly defined and closely reticulated (pl. 1, fig. 15), the lateral areas striate to curve. Petiole of abdomen a little shorter than swollen part of the segment and not so long as hind femur, convex above, the laterodorsal edges not definitely carinate, the lateroventral edges partly carinate. Legs and wings normal.

Length, 8 mm.

Type.—U.S.N.M. No. 44214, from Tucson, Ariz., on *Bigelovia hartwegi* (Towmey).

PSEN (MIMESA) PUNCTIFRONS, new species

Male.—Face white haired; underside of antennal flagellum yellow on entire extent except base of first segment. Apex of first, all of second, and anterior two thirds or more of third tergite red. Legs black, fore and mid tibiae yellowish brown, becoming fuscous or black below; fore and mid tarsi brownish yellow, hind pair dark brown centrally, becoming black at base, and paler brown apically. Wings grayish, stigma dark brown to black.

Front with rather deep punctures, which are very dense except close to eyes on each side above, the postocellar region finely striatopunctate to or slightly below curve, not tumid centrally; carina in front of anterior ocellus almost obsolete; clypeus almost evenly rounded in center of apex; antennal flagellum slightly clubbed at apex, penultimate and antepenultimate segments distinctly longer than thick, entire length of flagellum distinctly greater than that of head and thorax combined. Pronotum with a spikelike lateral process at each angle; mesonotum and scutellum glossy, without distinguishable shagreening, and with fine sparse punctures; eps 2 shining, rather coarsely and irregularly longitudinally striate, eps 1 glossy, with a few fine striae above and almost without sculpture on disk, not shagreened; propodeum with the enclosure rather small, the sculpture within it consisting of quite closely placed wavy striae, the areas adjacent to the enclosure finely striate anteriorly, becoming more coarsely so posteriorly, and rugoso-reticulate slightly before curve. Petiole fully as long as hind femur and over 1.5 as long as swollen section of the segment, convex above, with slight laterodorsal sulci and the edge beyond these quite sharply carinate, the sides almost straight, the lateroventral edges carinate; abdomen slenderer than in the *pauper* group. Legs and wings normal.

Length, 7-8 mm.

Type (U.S.N.M. No. 44215) and one paratype male, Redlands, Calif. (F. R. Cole).

PSEN (MIMESA) EDENTATUS, new species

Male.—Similar in color and general structure to *punctifrons*, differing mainly in the characters cited in the foregoing key.

The antennae are a little more markedly clubbed than in *punctifrons*, and not so long, with the underside more broadly ochreous, and the penultimate and antepenultimate segments not noticeably longer than thick, and in addition the sensory areas are not so sharply linear, being more moundlike and shorter as well as pale in color and situated in the pale instead of the dark part of segments 2 to 5 or 6. The front is quite markedly humped up or tumid just behind the space between the posterior ocelli, but there is no transverse impressed line in front of the hump; the sides of front between the ocelli and eyes are less densely punctured than in the other species referred to and lack striae; the clypeus has a slight central emargination; and the mandibles are without a well-developed inner tooth near the apex. Mesonotum with very fine shagreening, alutaceous; propodeum with the enclosure larger than in *punctifrons*, the sculpture almost rugoso-reticulate and not very coarse, the

lateral areas finely but irregularly striate anteriorly, coarser apically and rugoso-reticulate at curves; eps 2 more finely and irregularly longitudinally striate than in the preceding, the lower parts, eps 1, distinctly alutaceous and rather closely punctured on disk. Petiole hardly as long as in *punctifrons*, with very faint indications of dorsolateral sulci, and the sides not so definitely vertical. Legs and wings normal.

Length, 8 mm.

Type.—U.S.N.M. No. 44216, from San Diego County, Calif., April (Coquillett).

PSEN (MIMESA) IMPRESSIFRONS, new species

Male.—Similar to *edentatus*, but the fore and mid tibiae are not entirely brownish yellow, the color being as in *punctifrons*.

There is a rather noticeable impressed line in front of the frontal tumid area between the posterior ocelli that is not evident in *edentatus*, and the mandibles have a short but quite evident preapical inner tooth. Petiole slightly longer than in *edentatus*, with quite distinct sulcus on each side above.

Length, 8 mm.

Type.—U.S.N.M. No. 44217, from Perry, Wash., August 27, 1922 (M. C. Lane).

Another specimen which has some of the features of this and the preceding two species, the pronotum having a very distinct angle though not toothed, differs from *punctifrons* in having the post-ocellar tumid area, and from both the other species in having the mesonotum glossy and without evident shagreening. The petiole of the abdomen is also shorter, in fact so much so that it would place the species in another group. I deem it unwise to describe the species from the single specimen available, though I am practically certain that it will prove distinct. The antennal flagellum has the segments 2 to 5 more elevated centrally when seen from the side than do any of the three species just dealt with.

Locality.—Hood River, Oreg., June 30, 1921 (C. C. Spery).

In collection of the Bureau of Biological Survey.

PSEN (MIMESA) ARGENTIFRONS (Cresson)

PLATE 1, FIGURE 17

Mimesa argentifrons CRESSON, Proc. Ent. Soc. Philadelphia, vol. 5, p. 487, 1865.

I am not certain that the male which I accept as this species is correctly placed, but it agrees well with the description and is from Colorado, the type locality.

The salient characters for the identification of the male are given in the foregoing key, and there is little if anything to add thereto.

Length, 8 mm.

Locality.—Colorado, no other data (Baker collection).

PSEN (MIMESA) PYGIDIALIS, new species

PLATE 1, FIGURE 14; PLATE 2, FIGURE 22

Male and female.—Shining black, the abdomen in the male with the apex and lateral margins of first tergite and all the second and third tergites red, rarely with a dark mark on apex of latter, the female with entire first tergite and all the second and third tergites red, apices of the other tergites inconspicuously brown or yellowish brown. Face in male densely silvery haired, that of the female less densely white haired; underside of the antennal flagellum broadly testaceous-yellow except on basal segment. Legs black, apices of fore and mid femora in male rather conspicuously fulvous, all tibiae and tarsi in same sex fulvous, the hind tibiae generally browned centrally, and the hind tarsi largely fuscous; the pale color on the legs of the female much less, in the allotype present only on the anterior side of fore and apices of posterior side of hind tibiae, and to some extent on all tarsi, more preponderantly so on the fore pair. Wings grayish hyaline, veins and stigma dark brown.

Male.—Frons closely and finely punctured, most conspicuously so in front of the ocelli, least so laterad of the posterior ocelli, where it is rather glossy, the declivitous posterior part glossy and slightly granulose, not striate; space between the posterior ocelli greater than that between either and eye; lower part of back of head finely vertically striate; distance from eye to eye at lower level of antennal insertions a little greater than that from latter to apex of clypeus in center; face with dense appressed silvery white hairs; apex of clypeus with a central notch on each side of which there is a broadly rounded low lobe; antennal flagellum distinctly club-shaped, basal segment not so long as the next two combined, penultimate and antepenultimate segments not so long on underside as they are thick, second, third, and fourth segments each slightly elevated on one side, the elevation not evident except under a very high-power lens and neither highly polished nor distinguished in color. Mesonotum rather dull, microscopically shagreened or alutaceous, the punctures small and rather closely placed, scutellum not so closely punctured and more glossy; propodeum with the enclosure not very well marked and quite finely reticulate or rugose, the adjacent areas with slightly sinuous rugae, which become reticulations at the downward curve;

mesopleura finely punctured and distinctly shagreened, more definitely so posteriorly, the upper part (eps 2) longitudinally striate, but very finely so and with the white hairs so closely appressed that it is difficult to distinguish the sculpture. Abdomen exclusive of the petiole distinctly longer than head and thorax to apex of propodeum, the petiole subequal to the hind femur in length, with the dorsal surface convex in center and slightly sulcate along each side, the laterodorsal edges sharply carinate, lateroventral edges similarly formed and the sides slightly concave or sulcate; sixth tergite with a quite distinct raised line around apex and continued forward about one fourth of the length of the tergite so that there is quite a marked resemblance to the typical pygidium of the females of the genus. Legs normal, hind coxae elevated at bases on inner side, but not carinate. Wings normal.

Female.—Antennal flagellum narrower at base than in the male, the basal segment about as long as the next two combined on underside. Face less densely haired, the clypeus without definite central emargination and with a narrow transverse ridge a little before apex in center; frons less shining on sides above and more regularly punctured over all. Upper part of mesopleura more coarsely longitudinally striate, the hairs less dense than in male; propodeum more coarsely rugoso-reticulate, especially outside of the enclosure. Petiole of the abdomen slightly shorter and thicker than in the male, similarly formed. Legs stronger than in male, the spinose armature also stronger, the series of yellow spines on the posterior side of the fore metatarsus quite noticeably stronger.

Length, 9.5–11 mm.

Type (U.S.N.M. No. 49906), male, allotype, and four male paratypes, Bilby, Alberta, Canada, June 28, 1924 (O. Bryant).

The quite striking resemblance of the sixth abdominal tergite of the male of this species to that of normal females, although the pygidium is not so well developed nor so extensive, readily distinguishes it from any other as yet known to me in the subfamily.

PSEN (MIMESA) BOREALIS (Smith)

Mimesa borealis SMITH, Catalogue of Hymenoptera in the British Museum, pt. 4, p. 431, 1856. (Male.)

This species is very similar to *pygidialis*, but is much smaller, the male has no raised lines on the apical tergite of the abdomen, the female has the first tergite largely blackened at base, and the petiole of the abdomen is shorter. The antennal flagellum of the male is comparatively longer than in that species, with the sensory elevations very slightly evident in profile, and pale. The propodeum is much coarser sculptured, the enclosure having well-developed raised lines

longitudinally, with some transverse lines centrally, which divide the central area leaving no conspicuous glossy central diamond-shaped space, and the entire posterior face is quite coarsely reticulate, which sculpture extends to or almost to the lateral edges of the enclosure.

Length, 7-9 mm.

Originally described from the male taken in the Hudson Bay Territory, and subsequently both sexes were described by Fox from the same region. I have before me both sexes from Bilby, Alberta, June 28 and July 15, 1924 (Owen Bryant).

I have also a male specimen that appears to be referable here, but the upper part of the mesopleura (eps 2) is not definitely longitudinally striate and is instead rugoso-reticulate. I consider this specimen may be merely a variety of *borealis*. Locality, Nelson, N. H., September 1, 1907, no collector's name (U.S.N.M.).

PSEN (MIMESA) CINGULATUS (Packard)

Mimesa cingulata PACKARD, Proc. Ent. Soc. Philadelphia, vol. 6, p. 410, 1867.
(Male.)

I have not seen the type of this species, nor was it examined by Mr. Rohwer. I have, however, one specimen that I place here with much doubt. It has the femora partly browned, but in other characters agrees very well with the description.

Length, 7 mm.

Originally described from Brunswick, Maine. The National Museum specimen is from Colorado (Baker).

PSEN (MIMESA) PAUPER (Packard)

PLATE 1, FIGURE 18

Mimesa pauper PACKARD, Proc. Ent. Soc. Philadelphia, vol. 6, p. 409, 1867.
(Male.)

Mimesa paupera PROVANCHER, Nat. Can., vol. 13, p. 79, 1882. (Male and female.)

A rather small species which appears to be widely distributed throughout the Northeastern United States and Canada, extending as far west as Illinois. In the general coloration and habitus it closely resembles the species which I accept as *gregarius*, but the abdomen in both sexes has only the apex of the first and all second tergite red, this feature in the female being quite distinctive. The propodeum is very much coarser sculptured than in *gregarius* and *unicinctus*, the enclosure being coarsely rugoso-reticulate, and the lateral areas similarly but more finely sculptured almost to the edges of the enclosure. The petiole of the abdomen varies slightly in length and thickness, but it is never noticeably longer than the swollen part of the segment, and is sharply carinate on the dorsolateral and ventrolateral edges, with the sides almost straight.

The general rule is that the eps 2 is rather coarsely longitudinally striate and the upper edge of eps 1 has some faint striae, while below the surface is alutaceous and furnished with scattered shallow punctures, but sometimes there are more conspicuous longitudinal striae on the upper half or so of eps 1, and in one male I find even vertical rugae on the upper third. I do not care to accept these specimens as entitled to separation from *pauper* on the material available, but should the characters be met with in series of specimens, it would be well to consider them as distinct species.

Length, 6–7.5 mm.

Originally described from Illinois and recorded from New Jersey. Before me there are specimens from Salisbury Cove, Maine; near Bennings, D.C.; Bladensburg, Md.; Falls Church, Turkey Run, and Hunter, Va.; Nelson and Nerepis, N.H.; Chicago, Ill.; Ithaca, N.Y.; Massachusetts; and Canada, the last two without more definite localities. July to October.

PSEN (MIMESA) GREGARIUS Fox

Psen gregarius Fox, Trans. Amer. Ent. Soc., vol. 25, p. 16, 1898. (Male.)

Fox in his original description stated that this species is very similar to *unicinctus*, in which I concur. He distinguished *gregarius* mainly on the shorter and more clavate antennal flagellum and the coarser propodeal rugae. The exceptionally narrow second submarginal cell which he found in his type specimen is not characteristic of the species, a fact that he suspected might be the case. He did not note the differently colored underside of the antennal flagellum in the two species, which I use for the separation of *unicinctus* and another species from the remainder of this group.

The antennal flagellum in typical males has segments 2 to 5 with a rounded elevation on one side, which is highest at middle, but there are many specimens that do not have this elevation and possibly these should be separated as a distinct species. I do not care to go this far, so accept these as a variety, which is briefly distinguished below.

Length, 6.5–8 mm.

Originally described from Colorado. I have before me 1 male and 1 female from the same State, without other data (Baker collection).

PSEN (MIMESA) GREGARIUS SIMPLEX, new variety

Male and female.—Similar to the typical form in coloration, differing essentially in lacking sensory elevations on the antennal flagellum. The striae on the lateral areas of propodeum contiguous with the enclosure are very fine and diverge obliquely outward and slightly backward.

Length, 7–8 mm.

Type (U.S.N.M. No. 44218), male, and 1 male paratype, Adelaide, Idaho, June 22, 1927; allotype, same locality, June 24, 1929; and 1 male paratype, June 10, 1927. Paratypes: Idaho—Castleford, June 21, 1929; Milner, July 9, 1930; Paul, June 20, 1930; Oakley, July 1, 1927; Hollister, June 21 to August 1, 1930; Ximama, June 20 and August 14, 1930. Utah—Blue Creek, June 28 and August 5, 1929. Colorado—no other data (Baker collection).

Twenty-six specimens.

PSEN (MIMESA) MACULIPES Fox

Psen maculipes Fox, Trans. Amer. Ent. Soc., vol. 25, p. 17, 1898. (Male.)

Psen (Mimesa) nigrescens Rohwer, Ent. News, vol. 21, p. 168, 1910. (Male.)

Psen (Mimesa) perplexa Rohwer, Idem, p. 169. (Female.)

This is the only species of this subgenus known to me in which the abdomen of both sexes is without distinct red markings. In some respects it resembles species of the preceding subgenus, but the upper portion of the mesopleura (eps 2) is rather strongly longitudinally striate in both sexes, the petiole of the abdomen is not definitely trisulcate above except at extreme base, and the pygidium of the female is closely covered with quite large punctures, each of which holds the base of a decumbent apically directed stiff hair. The antennae of the male are quite noticeably clubbed at apices, the underside of the flagellum is broadly yellow except on basal part of the first segment, and segments 2 to 7 have each a rather broad elevated longitudinal glossy line on almost the entire extent of one side, least distinct, or even lacking, on the seventh segment. The female has the antennal flagellum even more noticeably clubbed than in the male and has the basal segment shorter than the next two combined.

Length, 7.5–8.5 mm.

Fox's type specimen was from Florida and has not been examined by me, and Mr. Rohwer did not report upon it in his notes on the type. I have carefully examined the type and paratype of *nigrescens* in the National Museum and am convinced that they are the same as Fox's species despite the more northern localities, New Jersey and Pennsylvania. The type specimen of *perplexa* is before me, and I have no hesitation in making the present assignment. Mr. Rohwer in his notes under the original description of *perplexa* says: "The female of *maculipes* Fox is undescribed, and *perplexa* is very like what we may expect this female to be, yet there are so many differences that *perplexa* seems distinct from the Florida species." It appears to me that practically all the distinctions are sexual, and there is no good reason why the sexes should be considered as belonging to two species.

Localities, in addition to those of type material: Highspire, Pa.; Lucaston, N.J.; Beltsville, Md., male; Chain Bridge, Va., male; and Canada, no further data, female.

The male has always the hairs on the face silvery white, and in the females before me there is some variation in the color of these hairs, one from Canada having them almost golden brown, while the type of *perpleceus* has them yellowish white.

This is the only species in which the abdomen is without red in both sexes, if my identifications and assignment of sexes are correct, but I have seen two males which I place in *pauper* that appear to have been too long in the killing bottle and the red is very much darkened, so that they appear to have the abdomen entirely black. The scutellum in *pauper* is distinctly longitudinally punctato-striate posteriorly, while in *maculipes* it is glossy and almost impunctate, a distinction that readily separates the males of the two species.

PSENIA, new genus

Generic characters.—Cubitus of hind wing with its base beyond the median transverse vein, as in *Diodontus* (pl. 2, fig. 23), the anal lobe more elongate than in that genus (pl. 2, fig. 24); occipital carina complete, continued round the back of the head and not connected with the one along the posterior and lateral margins of the mouth (pl. 2, fig. 27); posterior lateral lobe of the prothorax always pale, yellowish white; mandibles simple in both sexes; eps 2 not transversely striate, generally punctate and sometimes rugose or reticulate; second and third submarginal cells of fore wing each receiving a recurrent nervure, third submarginal cell shorter than in the other genera, its extreme length not so great as the distance from its apex to the apex of the radial vein, and not greater than its greatest width. The labrum has four short teeth, while in *Psen* the margin is rounded. In addition to these characters, the males have the hypopygial spine flattened dorsoventrally, very much shorter and stouter than in the other genera, frequently entirely concealed, the raised lines bordering the pygidium in the females are convergent on their anterior third or less, not parallel or almost so, the hind tibiae are distinctly curved when seen from above, and the hind tibial spurs of the males are much longer than in *Psen* and resemble more those of *Diodontus*, the posterior or inner one being but slightly thicker than the anterior or outer one only to short of the middle, where it is slightly angulate, and the females have a long downwardly directed bristly hair on each mid and hind coxa that is not found elsewhere in the subfamily.

Genotype.—*Mimesa tibialis* Cresson.

Remarks.—There are apparently four of the described North American species referred to *Psen* that must be transferred here. Viereck erected the genus *Neofoxia* for the reception of the species in which the cubitus of the hind wing has its base beyond the median transverse vein and includes *tibialis* Cresson and *suffusa* Fox in the list of species, but unfortunately he proposed the genus name merely as a substitute for *Psen* of Ashmead, not of Latreille, and designated *Psen atrata* Panzer as the genotype, which compels us to accept his genus as a synonym of *Diodontus* and to propose a new generic name for the North American species. There are several South American and West Indian species in the National Museum collection.

KEY TO THE SPECIES OF GENUS PSENIA

1. Males..... 2
 Females..... 13
2. Entire mesopleura highly polished, eps 1 sparsely and shallowly punctured, eps 2 entirely impunctate; area between ocelli depressed in center, with a few very minute punctures, posterior ocelli each with a deep impressed line behind them, which does not extend across between posterior margins; antennal flagellum distinctly clubbed, apical segment at base fully three times as thick as basal segment at its apex, and none of segments with evident elevated line or other modification; lateral angle of pronotum sharply produced, almost spikelike; abdomen black, apices of tergites brownish yellow..... *clavicornis*, new species
- Mesopleura generally shagreened or alutaceous and rarely very shiny, if almost glossy then with more distinct punctures, eps 2 always punctate or with other sculpturing; ocellar region not as above, usually quite distinctly punctured; antennal flagellum not clubbed or very inconspicuously so and at least some of intermediate segments modified..... 3
3. Antennal flagellum with 3 or 4 of segments toward middle with a quite conspicuous shining papillalike elevation on center of one side, the segments immediately basad and apicad of these with a short raised line or carina which does not extend the whole length of segments (pl. 2, fig. 28); entire mesopleura very coarsely sculptured, the punctures large, contiguous, and deep, giving surface appearance sometimes of being coarsely rugoso-reticulate; hind tarsi whitish yellow, apical segment browned above; space between mouth margin and black of head on central line moderately wide (pl. 2, fig. 29); width of exposed part of third ventral segment not nearly half as great as length of segment on median line.. 4
- Antennal flagellum more distinctly flattened below, inner side of flat part usually along entire length of segments 3 to 8 at least with a rather pronounced carina in dry material, which in cleared material appears as a bare line, which is slightly depressed and has margin of flat part overlapping it rather ridgelike, and no segment with well-developed papillalike elevations; mesopleura not so coarsely sculptured; third sternite wider at anterior margin except in *pallidistigma*..... 5
4. Basal three segments of flagellum lacking sensory elevations; eps 2 and prepectus coarsely rugoso-reticulate..... *longiventris*, new species
- Basal two segments of flagellum lacking sensory elevations; eps 2 and prepectus coarsely punctate, sometimes more or less vertically striatopunctate..... *suffusa* (Fox)

5. Hind tarsi with all segments more or less deeply infuscated, apices of basal four segments usually narrowly yellow, the distinction most easily seen when tarsus is viewed from apex against the light..... 6
 Hind tarsi either entirely yellow or with only apical and rarely basal segment partly browned..... 8
6. Basal four segments of flagellum without raised line; antennae black, only apical flagellar segment yellowish below; West Indies.
atricornis, new species
 At most basal two segments without a raised line; flagellum conspicuously yellow on almost entire length below; United States..... 7
7. Apical and basal two segments of flagellum without raised line, latter complete on all except preapical segment, and very fine, not darkened or shining; eps 2 alutaceous and with rather small punctures, eps 1 more definitely alutaceous and with larger punctures, more granulose than striate on posterior third..... *sayi* (Rohwer)
 Only basal segment of flagellum definitely without raised line, apical segment with a trace of one, the elevation broader than in *sayi*, on no segment extending completely along its length, darker than remainder of segments and slightly shining; eps 2 coarsely rugoso-reticulate, eps 2 more coarsely and closely punctate than in *sayi* and with posterior third rather coarsely striate..... *littoralis*, new species
8. Third ventral segment of abdomen not nearly half as wide on exposed part of its anterior margin as long in center; stigma pale yellow; occipital carina very much more elevated than usual, not vertical, and with a well-defined notch in the center below (pl. 2, fig. 30).
pallidistigma, new species
 Third ventral segment of abdomen much wider at anterior margin, exposed part much over half as wide as the central length of segment; stigma dark; occipital carina normal, moderately elevated and vertical..... 9
9. Flagellum with segments 5 to 8 quite distinctly, almost angularly, elevated on one side, highest point close to middle of each segment (pl. 2, fig. 31); propodeum laterad of enclosure very finely sculptured, striate or slightly reticulated, appearing almost granulose except under a high-power lens.
angulicornis, new species
 Flagellum with less evident elevations on intermediate segments, when these are visible in profile the highest point is well beyond the middle of segments; propodeum with coarser rugoso-reticulate sculpture laterad of enclosure (pl. 2, fig. 32)..... 10
10. Mesonotum with greater portion of its surface transversely and deeply striato-punctate, the scutellum longitudinally striato-punctate; head between ocelli and occipital carina finely but distinctly transversely striate..... 11
 Mesonotum deeply and subcontiguously punctate, without distinct transverse striae, scutellum with greater part of its surface rather finely punctate; back of head not striate..... 12
11. Legs except coxae fulvous-yellow; basal two segments of abdomen including petiole red, petiole castaneous..... *rufibasis*, new species
 At least hind femora partly and entire petiole black. *marginata*, new species
12. Enclosure as in plate 2, figure 33..... *tibialis* (Cresson)
 Enclosure as in plate 2, figure 34..... *aerofacies*, new species
13. Hind tarsi largely fuscous, yellow only at extreme apices of basal four segments, which pale color is best seen when tarsus is viewed from tip against the light..... 14
 Hind tarsi yellow, sometimes with apical segment browned above..... 17

14. Second and third tergites broadly black, red only on lateral portions of hind margins, pale color not extending entirely across posterior margin; West Indies..... *atricornis*, new species
Apex of first, all of second, and base of third tergite bright red; United States..... 15
15. Eps 2 evenly and quite prominently convex, microscopically shagreened or alutaceous, and with very small isolated punctures ($\times 34$), posterior part of eps 1 granulose, nowhere striate..... *sayi* (Rohwer)
Eps 2 moderately coarsely longitudinally striate or punctato-striate..... 16
16. Scutellum slightly alutaceous, not highly polished on disk and there rather uneven, the punctures quite large, deep, and isolated on each side, much closer and smaller on posterior margin..... *littoralis*, new species
Scutellum not alutaceous, highly polished on disk, punctures smaller and widely spaced except on posterior margin, where they are quite closely placed..... *texana*, new species
17. Femora and tibiae of all legs fulvous-yellow, the tarsi whitish yellow, all of first and second tergites of abdomen red, petiole castaneous, remainder of abdomen glossy black, the apices of tergites brownish yellow; eps 2 coarsely punctato-striate, eps 1 not distinctly shining because of presence of fine shagreening or alutaceous sculpturing, the punctures on upper part large and contiguous, gradually becoming smaller and wider spaced toward lower level; prepectus vertically striato-punctate on upper part; propodeum coarsely rugoso-reticulate on entire dorsum and to a large extent on sides; space between occipital carina and one around mouth not nearly so wide as first segment of fore tarsus seen from above; hairs of face with a distinct golden tinge..... *rufibasis*, new species
Femora and tibiae not entirely yellow, at least former and hind tibiae partly black or dark brown; first tergite at least largely black; other characters not as above in their entirety..... 18
18. Intercarinal space in center of ventral surface of head as wide as first segment of fore tarsus seen from above..... 19
Intercarinal space in center of ventral surface of head not nearly so wide as first segment of fore tarsus seen from above..... 20
19. Abdomen partly bright red, apex of second and usually all of third tergites red; fore and mid tibiae whitish yellow, more reddish yellow on anterior and posterior surfaces, hind tibiae as usual, yellowish white on basal third or less and dark brown or fuscous beyond; mesopleura with moderately large shallow punctures, well separated on upper half of eps 1 and more closely placed and smaller on eps 2..... *suffusa* (Fox)
Abdomen glossy black, apices of tergites brownish yellow; all tibiae black, fore pair whitish yellow on dorsal surface almost to apex and on almost all of anterior surface, mid and hind pairs whitish yellow on basal third or less; mesopleura with eps 2 closely punctato-striate, and upper part of eps 1 coarsely subtransversely wrinkled and with a few large punctures, the wrinkles fading out near midway to lower extremity and replaced by rather large sparse shallow punctures.
longiventris, new species
20. Mesonotum coarsely and rather irregularly rugoso-punctate, almost furrowed, especially on disk and anterior lateral angles; mesopleura very minutely shagreened, alutaceous, eps 2 with shallow punctures and traces of longitudinal wrinkles, eps 1 much more distinctly wrinkled and punctured on upper half, sculpturing becoming fainter below; propodeum

- coarsely rugoso-reticulate, becoming striate basally alongside enclosure; abdomen glossy black, apices of tergites rather conspicuously brownish yellow to testaceous in color..... *marginata*, new species
- Mesonotum not at all rugose or furrowed on disk, anterior lateral angles with separated punctures; eps 1 not wrinkled longitudinally on upper half..... 21
21. Abdomen very conspicuously red on at least some part of one or more of first three tergites; propodeum with very fine straight striae on almost entire length along sides of enclosure, which are directed obliquely outward and backward, and posterior face finely reticulate rugose, appearing under a moderately high-power lens as almost granulose..... 22
- Abdomen not at all red on any part of any of first three tergites, though apices of these may be brownish yellow; propodeum except in *minuta* more coarsely sculptured along sides of enclosure and posterior face coarsely reticulate..... 25
22. Smaller species, not more than 7 mm in length, with abdomen extensively red, usually apex of first tergite, all of second, and at least base of third, red; occipital carina practically obsolete for some distance on each side of central line below..... 23
- Larger species, not less than 7 mm in length, with abdomen less extensively red, sometimes with second tergite largely black basally; occipital carina well developed, erect, to central line below..... 24
23. Eps 2 almost glossy and with very small punctures. *angulicornis*, new species
Eps 2 but slightly shining and with moderately large subcontiguous punctures..... *angulicornis* var.
24. Second abdominal tergite extensively blackened on basal half or more; eps 2 dull, appearing granulose, and with extremely small punctures, which are not clearly discernible even with a magnification of 150; apical segment of hind tarsus brown, darker than other segments; petiole of abdomen not half as long as hind femur..... *brevipetiolata* (Rohwer)
- Second abdominal tergite entirely red; eps 2 distinctly shining, faintly alutaceous, with rather widely separated punctures quite distinct under a magnification of 150; apical segment of hind tarsus whitish yellow like the other segments..... *pallidistigma*, new species
25. Small species, 5 mm in length; sculpture of propodeum except enclosure very faint, consisting of fine striae, which are visible only posteriorly at curve under a magnification of 34 diameters, posterior face without distinguishable reticulations..... *minuta*, new species
- Larger species, about 7 mm in average length; sculpture of propodeum much coarser, consisting of rugose reticulations on most of area outside of enclosure..... 26
26. Petiole as long as thick part of first abdominal segment; pygidium not twice as long as its width at center; propodeum with rather fine reticulations, enclosure without a large glossy diamond-shaped central area..... *albifacies*, new species
- Petiole of abdomen not so long as remainder of first segment; pygidium more than twice as long as its width at center; propodeum coarser sculptured..... 27
27. Hairs of face silvery white; enclosure of propodeum without a large diamond-shaped glossy central area (pl. 2, fig. 33)..... *tibialis* (Cresson)
- Hairs of face brassy yellow; enclosure of propodeum with a large diamond-shaped glossy central area (pl. 2, fig. 34)..... *aerofacies*, new species

PSENIA TIBIALIS (Cresson)

PLATE 2, FIGURES 27, 33, 38

Mimesa tibialis CRESSON, Trans. Amer. Ent. Soc., vol. 4, p. 488, 1872. (Male and female.)

This species is black in both sexes, with a more evident pale posterior margin to the segments in the female than in the male, the face is silvery white haired, antennal flagellum broadly yellow below on entire extent except on the first segment, the fore and mid tibiae and all tarsi yellow, hind tibiae broadly blackened in middle, to apex on the outer side, hind tarsus of female usually with the apical segment browned above.

The antennal flagellum of the male is not at all clubbed, while that of the female is distinctly so, the sensory areas on the male flagellum are linear, present usually on all but the apical and basal two segments, though there is some variation in the presence or absence on the penultimate, and usually the last or even the one preceding it is distinctly shorter than the other, not extending along the entire length of the segment. The enclosure of the propodeum is irregularly rugoso-reticulate (pl. 2, fig. 33), and the areas laterad of the latter are rather coarsely reticulate, the mesopleura is almost dull because of the presence of shagreening, and the punctures are rather large though not deep, and moderately widely separated, closer on eps 2. The female pygidial area is usually about 2.5 as long as wide in center.

Length, 6-7.5 mm.

Originally described from Texas and District of Columbia. I have seen it from these localities and also Louisiana.

The District of Columbia male lacks a sensory area on the apical three flagellar segments.

PSENIA AEROFACIES, new species

PLATE 2, FIGURE 34

Female.—Very similar to *tibialis*, differing essentially in the yellow haired face and the sculpture of the propodeal enclosure (pl. 2, fig. 34).

Male.—Similar to the male of *tibialis*, the face being silvery white haired, but the propodeal enclosure is sculptured as in the female.

Length, 7.5-8.5 mm.

Type (U.S.N.M. No. 44219), female, Rosser, Tex., June 28, 1905, on *Cassia* sp., Hunter No. 450 (C. R. Jones). Allotype, Victoria, Tex., July 8, 1907, on *Acacia* sp. (J. D. Mitchell). Paratype male, Mexico, no other data (Baker collection).

PSENIA ALBIFACIES, new species

Female.—Very similar to the female of *tibialis*, differing in having the abdomen without distinct pale apices to central part of the tergites, the pygidium not so long or so narrow, the occipital carina obsolescent as it nears the central line on ventral surface of head and the intercarinal space rather wider. The enclosure of the propodeum is quite similar to that of *tibialis*, but the striae on upper part of the lateral areas outside of it are finer. The mesopleura is also more finely punctured, especially on eps 1, where it is rather distinctly shining.

Length, 8 mm.

Type.—U.S.N.M. No. 44220, from Sioux City, Iowa, July 13, 1929 (C. N. Ainslie).

PSENIA CLAVICORNIS, new species

PLATE 2, FIGURE 35

Male.—A small shining black species much resembling a small specimen of *suffusa*, but the abdomen has a narrow reddish apex to the first and second tergites and the apices of the following tergites yellowish brown. The face is silvery white haired, the antennae are testaceous-yellow, with the scape and upper surface of the flagellum fuscous. Femora dark brown except at apices, tibiae and tarsi testaceous-yellow, hind pair yellowish brown except at bases, the latter not very much paler than the remainder, hind tarsus with the apical segment hardly darker than basal four. Stigma and wing veins brown.

Frons glossy, appearing impunctate except under a very high-power lens, the ocelli well elevated, the surface sunken between the ocelli, the distance between the posterior pair subequal to that between either and eye margin; antennal flagellum about as long as head and thorax, much clubbed apically, the penultimate and antepenultimate segments distinctly wider than long, and no segment with distinguishable sensory elevated area. Mesonotum and scutellum with small widely separated punctures on a glossy surface; mesopleura glossy, eps 2 apparently impunctate, eps 1 with very small piliferous punctures, which are widely separated and visible only under a magnification of about 50 diameters; propodeum with the sculpture rather coarse, enclosure as in plate 2, figure 35, the areas laterad of it quite widely striate, becoming rugoso-reticulate on the curve and posterior face. Abdomen slender, petiole about four fifths as long as hind femur, gradually merging into the thickened part, which is not half as wide at apex as its length from there to petiole; basal exposure of third tergite not half as wide as length of sternite in center. Legs and wings normal for the genus.

Length, 6.5 mm.

Type.—U.S.N.M. No. 44221, from Arizona (no. 2546, Baker collection).

The antennae are typical in general shape to those of normal females of the genus, but the number of segments is that usually found in males, so that the possibility of the type being a hermaphrodite is extremely remote.

PSENIA SUFFUSA (Fox)

PLATE 2, FIGURES 23, 29, 36, 37

Psen suffusus Fox, Trans. Amer. Ent. Soc., vol. 25, p. 18, 1898. (Female.)

This species was originally described from females only, and it is surprising to discover, if my determination is correct, that there is a striking sexual dimorphism in the species, the male being slenderer and having the mesopleura very much more deeply and more closely punctured than the female. The abdomen in the male has merely the apices of the tergites on basal half red with a greater extension of that color on the venter, while the female has the apex of second and usually the basal half or more of the third segment red.

Structurally the male is very similar to that of the next species, but the characters listed in the key readily separate them. In *clavicornis* the form of the abdomen is similar to that of this and the next species, but in neither of the latter is the antennal flagellum at all clavate or lacking sensory areas. I believe the structure of the sensory areas is sufficient to distinguish *suffusa* and *longiventris* from their allies, and an important additional character, present to the same degree in both sexes, is the exceptional central width between the carinae on the center line of the ventral surface of the head. I figure the male hypopygium of *suffusa* to show the relative positions of the various segments comprising it (pl. 2, fig. 36). The female has the pygidial area fully twice as long as its width at center, the mesopleura sparsely supplied with rather large punctures, smaller and more closely placed on eps 2, the enclosure of the propodeum more closely reticulated than in *longiventris*, and the areas laterad of it very finely striate up to the curve where they become reticulate. The abdomen of the female is stouter than in the male, with shorter petiole and wider bases to the sternites.

Length, 6.5–8 mm.

Originally described from Las Cruces and Rincon, N.Mex. I have a large series of both sexes before me, two being from Las Cruces. The others are from the following localities: Mesilla, 2 miles north of Vado, and La Luz, N.Mex.; Phoenix, Higley, Tucson, and Sacaton, Ariz.; and Lindsay and Redlands, Calif.

I am quite confident that Fox had more than one species in his type series as he states that the abdomen may be more preponder-

antly red than I describe above, and particularly as he states that the hind tarsi may be entirely yellow or with merely yellow rings. I suspect that a critical examination of the types will disclose that there is a mixture of *suffusa* as here accepted and *sayi* Rohwer or a closely allied species. However, I restrict the name to the form with entirely yellow hind tarsi as here described.

PSENIA LONGIVENTRIS, new species

PLATE 2, FIGURE 28

Male and female.—Very similar to *suffusa*, differing in its darker color as indicated in the key for both sexes, and in the male in the structure of the antennal flagellum and the sculpturing of the mesopleura. The specimens average larger than those of *suffusa* and the enclosure of the propodeum is very similar to that of *clavicornis*, though the lateral areas are much more finely striate. The stigma of the wing in this and the preceding species is fuscous, and the occipital carina is not at all reflexed outward as in *pallidistigma* but erect.

Length, 8–9 mm.

Type (U.S.N.M. No. 44222), male, and 13 male paratypes, Higley, Ariz., July 15, 1917 (E. G. Holt); allotype, Gilbert, Ariz., July 18, 1917 (E. G. Holt). Paratypes, all males: 3, Holtville, Calif., July 26, 1917, one on cotton (E. A. McGregor); 12, Lindsay, Calif., on *Helianthus*, orange, and *Asclepias* (W. A. Davidson, C. E. Pemberton); 1, El Centro, Calif., on cotton (W. D. Pierce); 2, Mount Superstition, near Higley, Ariz., July 24, 1917 (E. G. Holt); and 1, Arizona, without more definite locality (Baker collection).

PSENIA PALLIDISTIGMA, new species

PLATE 2, FIGURES 30, 39

Male and female.—Very similar in general coloration to *suffusa*, but the wings are more decidedly whitish hyaline, the stigma is paler, brownish yellow in male, and the male has the abdomen more broadly red, while both sexes have no brown color on the apical segment of the hind tarsus.

Structurally the male differs from that of either of the two next preceding species in the more elongate sensory areas of the antennal flagellum, which are present on the fourth to tenth segments, inclusive, and the peculiarly reflexed lower portion of the occipital carina (pl. 2, fig. 30), a character not met with elsewhere in the genus as far as I have found. The female has this feature lacking, but it has the same closely rugoso-reticulate propodeal enclosure as the male (pl. 2, fig. 39), a rather striking character. The mesopleura

and prepectus are rather deeply but not contiguously punctate, the eps 2 more closely so. Lateral areas of the propodeum appearing almost granulose in the male, but under a high-power lens distinctly rugose or reticulate, in the female these areas are closely and rather evenly striate almost up to the curve, at which point they become rugose. Petiole of the abdomen in the male almost as long as the hind femur and longer than the swollen apical part. Legs and wings normal.

Length, 8-9 mm.

Type (U.S.N.M. No. 44223), male, Mount Superstition, near Higley, Ariz., July 24, 1917 (E. G. Holt); allotype, Cotulla, Tex., May 11, 1906 (J. C. Crawford). One male paratype, Higley, Ariz., July 15, 1917 (E. G. Holt).

PSENIA RUFIBASIS, new species

PLATE 2, FIGURE 32

Male and female.—This species does not belong to the same group as *suffusa*, the intercarinal space on venter of head being much narrower and the abdominal petiole shorter. The hairs of the face in the female are brassy yellow, the antennal scape is broadly yellow below in male and at apex in female, and the flagellum is broadly yellow below on even the basal segment. Petiole of abdomen chestnut-colored, first and second tergites entirely red in female, partly dark on disk in male. Femora and tibiae of all legs fulvous-yellow, bases of hind tibiae and all the tarsi more whitish yellow. Fore wings brownish hyaline, veins and stigma dark brown.

Female.—Front with small separated punctures; clypeus almost rounded at apex; intercarinal space at center about half as wide as basal segment of fore tarsus at apex. Mesonotum broadly longitudinally punctato-striate on disk, the scutellum similarly sculptured; enclosure of propodeum as in plate 2, figure 32: mesopleura dull, shagreened, with rather coarse punctures in wrinklelike striae, which are oblique on lower part and closer and almost longitudinal on upper part (eps 2). Petiole about three fourths as long as hind femur and subequal to the apical part of the segment; pygidium about 2.5 as long as its width at center. Legs and wings normal.

Male.—Differs from the female in having the face white haired, the flagellum not clubbed, flat below and with a linear sensory elevation on basal and apical segments, faint on preapical one.

Length, 8-8.5 mm.

Type.—U.S.N.M. No. 44424, female, Jekyll Island, Ga., June 25, 1923 (W. L. McAtee); allotype, Tifton, Ga.

In keeping with the practice of the Bureau of Biological Survey, the type specimen is presented to the National Museum.

PSENIA MARGINATA, new species

PLATE 2, FIGURE 40

Male and female.—Very similar to *rufibasis*, but that species is readily distinguished in both sexes by the predominantly red color of the basal two segments on the abdomen, even the petiole being chestnut-red. The petiole in *marginata* is glossy black, the first tergite is narrowly and the other tergites more broadly testaceous at apices, though in one male the pale apices are more red than yellow. The femora in both sexes of typical examples are largely black or dark brown, paler at apices of the fore and mid pairs, and the tibiae and tarsi are yellow, the hind tibiae largely black beyond the whitish yellow basal third. Facial hairs of female yellowish white.

In structure there is very little difference between this species and *rufibasis*, the coarse sculpture of the entire thorax setting them apart from other closely allied species. Apical sternite of male as in plate 2, figure 40.

Length, 7–9 mm.

Type (U.S.N.M. No. 44225), female, allotype, and six paratype males, Louisiana, no other data (Baker collection). Paratypes, male and female, Opelousas, La., no other data (G. R. Pilate), and Yemassee, Buckfield Plant., S.C., October 1, 1926 (J. T. Rogers).

The last listed specimen is a male that is larger than the others, 10.5 mm, and has the femora with the exception of the extreme bases of the hind pair fulvous-yellow. I do not care to consider it as other than a variety of *marginata*.

PSENIA BREVIPETIOLATA (Rohwer)

PLATE 2, FIGURE 41

Psenulus (Neofoxia) brevipetiolatus ROHWER, Proc. Ent. Soc. Washington, vol. 12, p. 100, 1910. (Female.)

I have examined the type specimen in the National Museum, and though the abdomen has been broken off through the petiole and rather badly glued together the characters are sufficiently well preserved to enable me definitely to place it in the key and to determine another female now before me as belonging to the species. The very finely sculptured eps 2 of this species is distinctive, this part of the mesopleura appearing granulose even under a very high-power lens, the lower part, eps 1, being very finely shagreened or alutaceous and furnished with sparse small punctures. The propodeum has the enclosure with rugae, and the lateral areas finely striate (pl. 2, fig. 41). The petiole of the abdomen is about half as long as the swollen part of the segment and not more than half as long as the hind femur; apex of second and base of third tergite red; pygidium about

three times as long as its width at center. The head is as in *rufibasis*, but the intercarinal space is even narrower in center, there is a quite marked thickening or angle of the occipital carina on each side in line with the lower margin of each eye which is not evident in most of the other species, the antennal scape is fuscous, and the hairs of the face are white.

Length, 8 mm.

Originally described from Los Angeles County, Calif. The single female before me, in addition to the type, is from Lindsay, Calif., on *Asclepias* (W. A. Davidson).

The correct type number of this species is U.S.N.M. No. 12855, not 12355 as published.

PSENIA SAYI (Rohwer)

Psenulus (Neoforia) sayi ROHWER, Proc. Ent. Soc. Washington, vol. 12, p. 100, 1910. (Female.)

This species is one of a group in which the hind tarsi are fuscous, with the apices of the basal 4 segments narrowly yellow, which annulation is best seen when the tarsus is viewed from the tip against the light. The various species are best distinguished by the sculpture of the mesopleura and the propodeum as stated in the foregoing key.

The mesopleura in the male is more distinctly shining than in the female, and the punctures are larger, especially on the upper portion and posteriorly on the lower portion, on the latter assuming the appearance of reticulations or irregular striae. The petiole of the abdomen in the male is also longer than in the female, in some specimens almost as long as the hind femur. The fore and mid femora are yellow above to a variable extent in both sexes, the abdomen in the male has in the Alabama and Louisiana specimens a preponderantly blacker tone than in the series before me from Arizona, the apices only of the first and second and the base of the second tergites being more or less broadly reddish, while in the Arizona specimens the entire second segment and a large part of the anterior half of the third segment are red. The Arizona specimens are also slightly longer and slenderer, though it is my opinion that they belong to this species. I have seen no females from Arizona that I can refer here. The available females are all from farther east, and all have the apex of the first, all of the second, and at least the basal half of the third tergite red. The flagellar elevations of the male are linear and are present on the third to tenth segments as a rule, though there may be a very faint trace on the second and sometimes hardly a trace on the tenth segment. The space between the carina

on the central part of ventral surface of the head is very narrow, similar to that of *tibialis*, which it closely resembles in many respects.

Length, 6-7 mm.

Originally described from Onaga, Kans., U.S.N.M. No. 12856. There is one paratype so labeled by Mr. Rohwer and bearing the same number as the type, from Texas, which is not listed as a paratype, though no doubt it is the specimen referred to in the concluding paragraph under the description as "the species recorded as *Mimesa pauper* by Cresson in Hymenoptera Texana."

Other localities represented by material before me are as follows: District of Columbia, Louisiana, Alabama, New Mexico, and California.

PSENIA TEXANA, new species

Male and female.—Very similar to *sayi* and the species following this, differing from the first named in the coarser sculptured upper part of the mesopleura (eps 2) and from *littoralis* in having the scutellum more highly polished, and no evident sensory elevation on the second flagellar segment. The female in particular has the scutellum highly polished and smooth as against the quite uneven and dull surface of that part in *littoralis*. The hind tibiae in both sexes have a lesser proportion of their base yellow than is the case in the other species, but I do not place much dependence upon this as a distinguishing specific character.

Length, 6-7.5 mm.

Type (U.S.N.M. No. 44226), female, allotype, and one female paratype, Brownsville, Tex., 1921 (J. C. Bridwell).

PSENIA LITTORALIS, new species

Male and female.—Shining black. Antennal flagellum yellow below on entire extent in the male, and except on basal segment in female; facial hairs silvery white in both sexes. Mesopleura not so distinctly shining as mesonotum. Abdomen shining black, apices of first three and bases of second and third tergites rather narrowly red in male, apex of first, all of second, and base of third red in female. Femora black, in male partly yellow above and at apices of fore and mid pairs, tibiae of fore and mid legs yellow, partly browned below in female only, fore and mid tarsi yellow, apical segment of mid pair brown in female; hind tibiae blackened except at bases; hind tarsi fuscous, the apices of all segments narrowly yellow. Wings grayish hyaline, stigma and veins fuscous.

Male.—Antennal flagellum not clubbed, longer than head and thorax combined, the sensory areas almost linear, black, entire, present on all but the basal and apical segments, and sometimes rudi-

mentarily so on apical one; intercarinal space on center of ventral surface of head almost linear; front finely punctured, more glossy and less closely punctured between ocelli; space between posterior ocelli greater than distance of either from eye. Mesonotum with moderate sized and quite deep punctures which are not regularly arranged but more aggregated along the linear depressions; scutellum similarly punctured, least closely so on disk, the apex with a central depressed longitudinal line that does not extend to anterior margin; mesopleura with deep closely placed punctures about as large as those on mesonotum, eps 2 appearing rugoso-reticulate. Propodeum as in *tibialis*, the central part of enclosure without a definite bare glossy diamond-shaped area, and the reticulations extending up to the lateral edges of enclosure. Petiole about as long as the enlarged part of the segment and fully two thirds as long as hind femur. Legs and wings normal.

Female.—Antennal flagellum clubbed; clypeus with the central third almost transverse, the extremities of that part with a slight angle. Mesopleura with the punctures much smaller and wider placed than in male, eps 2 striate.

Length, 7–8 mm.

Type (U.S.N.M. No. 44227), male, Chesapeake Beach, Md., July 3, 1924 (J. R. Malloch); allotype, same locality, July 2, 1916 (W. L. McAtee).

The specimens have been donated to the National Museum by the collectors.

PSENIA ATRICORNIS, new species

Male and female.—The male is much darker in color than any of the three next preceding species, having the abdomen appearing entirely black on dorsum except the narrow and rather indistinctly paler apices to the tergites, and the antennal flagellum black except at extreme tip where it is brownish yellow. The female which I place with this male is marked with red triangles on each anterior lateral angle of the third, and the posterior lateral angles of second and third tergites when seen from above, the incurved ventral parts of the tergites and the sternites of these segments almost entirely red. The antennal flagellum is also yellow below except on the basal segment. The hairs of the face are silvery white in both sexes. The male has the sensory areas of the flagellum much as in *littoralis*, but the type specimen has the basal two without elevations and the apical one with a partial one at base. The male has the lower part of the mesopleura with large punctures, becoming striato-punctate anteriorly, and the upper part, eps 2, with small punctures. The female is much less coarsely punctate on these parts, the eps 2 being but feebly punctured. Propodeum as in *littoralis*. Petiole in male

as long as remainder of segment and about two thirds as long as hind femur. In female distinctly shorter than remainder of the segments and about half as long as hind femur. Wings and legs normal.

Length, 7–8 mm.

Type (U.S.N.M. No. 44228), male, Aguadilla, Puerto Rico, January 1899 (A. Busck). Allotype, Baragua, Cuba, February 12, 1925, at light, T.P.R.F., Ent. No. 346 (C. F. Stahl); paratype female, Santiago de las Vegas, Cuba, June 21, 1917 (R. Cardin).

My association of the sexes may be erroneous but there is no way to determine if this is so.

A male from Portland, Jamaica, may belong to this species, but it lacks the abdomen and is otherwise in poor condition. The abdomen that is mounted on the card with it is that of a female of the genus *Psen.* subgenus *Mimumesa*.

PSENIA ANGULICORNIS, new species

PLATE 2, FIGURE 31

Male and female.—Very similar in general coloration to *sayi*, the abdomen of the male with the apices of first three tergites and bases of second and third red, the second segment usually entirely and sometimes all or nearly all of the third tergite in the female red. The hind tarsi are entirely whitish yellow, or the apical segment is slightly brownish above.

The antennal flagellum of the male is quite distinctive (pl. 2, fig. 31) being almost angularly elevated in center of one side on segments 5 to 8. The propodeum has the enclosure rather finely rugoso-reticulate in both sexes, and the lateral areas are finely divergently striate above, becoming finely rugoso-reticulate at the curve. Petiole in male longer than in female, as long as the swollen part of the segment and about three fourths as long as hind femur, in female about half as long as hind femur. Occipital carina evanescent as it approaches central line of ventral surface, the intercarinal space almost linear. Wings and legs normal.

Length, 6–6.5 mm.

Type (U.S.N.M. No. 44229), male, allotype, and two female paratypes, Plano, Tex., July 1907 (E. S. Tucker). Paratypes: One female, same locality as type, August 1907 (E. S. Tucker); male, Neucrest, Tex., April 28, 1896 (C. L. Marlatt); male, Brownsville, Tex., 1921 (J. C. Bridwell); female, Tifton, Ga., no other data (Ashmead collection).

The last listed specimen is slightly different from the others.

PSENIA MINUTA, new species

Female.—Similar in general habitus to *angulicornis* but with the abdomen shining black, with rather faint pale apices to the tergites. Structurally the species resembles *clavicornis*, but the mesopleura is more distinctly punctured, the eps 2 having sparse rather small punctures on the entire surface, which would not be the case if the general rule in the genus held here as the male has that sclerite impunctate. The enclosure of the propodeum is quite similar to that of *aerofacies* but smaller and more finely reticulated, and the propodeum outside of the enclosure is very finely striate, even on the posterior face, the striae diverging from the central impression to each side and almost without connecting reticulations. The pygidium is a little wider than in *angulicornis*, being about as in *tibialis*. Inter-carinal space narrow, the occipital carina complete but not prominent. Legs and wings normal. Petiole not as long as remainder of segment.

Length, 5.5 mm.

Type.—U.S.N.M. No. 44230, from San Diego, Tex., May 16 (Ashmead collection).

EXPLANATION OF PLATES

PLATE 1

- FIGURES 1, 2. *Diodontus trisulcus*: 1, Wings; 2, hypopygidium of male (*a*, dorsal view of right half; *b*, lateral view from left side).
3. *Psen* (*Pseneo*) *fulvipes*: Apex of clypeus of female.
4. *P.* (*P.*) *kohlil*: Hind femur, posterior view.
- 5, 6. *P.* (*Psen*) *monticola*: 5, Fore wing; 6, hind wing.
- 7, 8. *P.* (*Mimamesa*) *clypeatus*: 7, Ventral view of right side of head; 8, apex of clypeus of female.
9. *P.* (*M.*) *niger*: Ventral view of right side of head.
10. *P.* (*M.*) *mellipes*: Antenna of male.
11. *P.* (*M.*) *modestus*: Propodeum.
12. *P.* (*M.*) *modestus* var. *reticulatus*: Propodeum.
- 13, 21. *P.* (*Mimesa*) *ressoni*: 13, Propodeum; 21, male hypopygidium (*a*, dorsal view of right side; *b*, lateral view from right; *c*, apical ventral styles in profile).
14. *P.* (*M.*) *pygidialis*: Apex of sixth tergite of abdomen of male.
- 15, 16. *P.* (*M.*) *arizonensis*: 15, Propodeum; 16, petiole of abdomen from left.
17. *P.* (*M.*) *argentifrons*: Petiole of abdomen from left.
18. *P.* (*M.*) *pauper*: Petiole of abdomen from left.
19. *P.* (*M.*) *proximus*: Apex of clypeus of female.
20. *P.* (*M.*) *coquilletti*: Apex of clypeus of female.

PLATE 2

- FIGURE 22. *Psen* (*Mimesa*) *pygidialis*: *a*, Internal hypopygial processes; *b*, penultimate abdominal sternite of male.
- 23, 29, 36, 37. *Psenia suffusa*: 23, Hind wing; 29, central ventral portion of carinae of head; 36, hypopygidium of male (*a*, ventral view of right side; *b*, dorsal view of right side; *c*, apex of terminal portion of style of *marginata*); 37, ventral view of apical sternites of male with hypopygidium in normal position.
24. *Diodontus* sp.: Anal lobe of hind wing.
25. *Psen* sp.: Anal lobe of hind wing.
26. *Psenia* sp.: Anal lobe of hind wing.
- 27, 33, 38. *Psenia tibialis*: 27, Ventral view of right side of head; 33, enclosure of propodeum; 38, apical and preapical sternites of male from below.
28. *P.* *longiventris*: Antenna of male.
- 30, 39. *P.* *pallidistigma*: 30, Ventral view of right side of head; 39, enclosure of propodeum.
31. *P.* *angulicornis*: Antennal flagellum of male.
32. *P.* *rufibasis*: Enclosure of propodeum.
34. *P.* *aerofacies*: Enclosure of propodeum.
35. *P.* *claricornis*: Enclosure of propodeum.
40. *P.* *marginata*: Apical sternite of male. (See also figure 36, *c.*)
41. *P.* *brevipetiolata*: Enclosure of propodeum.

NEW SPECIES OF BUPRESTID BEETLES FROM MEXICO AND CENTRAL AMERICA

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This paper is the result of a study of the beetles of the family Buprestidae from Mexico and Central America found in the collection of the United States National Museum, together with a large number received for identification from H. E. Hinton, of Berkeley, Calif.

Thirty species of eight genera are herein described as new, and through the kindness of Mr. Hinton the type specimens have been placed in the collection of the United States National Museum.

COLOBGASTER AUREOVIRIDIS, new species

Female.—Broadly oblong, feebly narrowed in front and behind, and feebly convex; head and antennae aureo-virideous, the latter slightly aeneous; pronotum, scutellum, and elytra aureo-virideous, with a distinct cupreous tinge in certain lights; beneath aureo-virideous, with the tarsal lobes and posterior margin of the second, third, and fourth abdominal segments feebly bluish black.

Head with the front rather flat, uneven, broadly, longitudinally depressed on the front, the depression deeper between the antennal cavities and near the vertex, where there is a vague heart-shaped elevation, and with a narrow, longitudinal groove on the occiput; surface coarsely, irregularly, and more or less confluent punctate, sparsely clothed with inconspicuous hairs, and the intervals finely, densely granulose; epistoma vaguely, broadly, arcuately emarginate in front.

Pronotum moderately, uniformly convex, distinctly narrower at apex than at base, widest near base, with a round, vague depression on each side of middle, and a more distinct depression on each side near posterior angle; sides feebly sinuate, strongly, obliquely expanded from apical angles to near base, then obliquely narrowed to the posterior angles, which are acute, but not projecting beyond the elytra: anterior margin transversely truncate; base broadly.

deeply, arcuately emarginate at middle of each elytron, with the median lobe transversely truncate in front of scutellum; surface rather coarsely, densely, irregularly punctate, smooth in front of scutellum, and the intervals vaguely granulose. Scutellum triangular, acuminate at apex, and the surface finely, densely, vaguely granulose.

Elytra wider than pronotum at base, and slightly wider at base than at middle; humeral angles broadly rounded; sides nearly parallel from base to near middle, then feebly, arcuately narrowed to the tips, which are separately broadly rounded, with a distinct tooth near the sutural margin; surface finely, densely, uniformly punctate, and each elytron with two or three more or less distinct, smooth, longitudinal costae, and a round, deep, basal depression.

Abdomen beneath densely, finely granulose, rather densely, finely, irregularly punctate, and sparsely clothed at sides along anterior margin of segments with long, recumbent, white pubescence; first segment broadly, longitudinally grooved at middle; last segment with two broadly arcuate emarginations at apex, forming a distinct tooth on each side and one at middle of equal length. Prosternum strongly convex, vaguely granulose, sparsely, irregularly punctate, and sparsely clothed with fine, erect, white hairs; anterior margin slightly elevated; prosternal process obliquely expanded posteriorly, with the apex broadly angulated.

Male.—Differs from the female in having the last abdominal segment broadly, feebly, arcuately emarginate at apex, and with a long tooth on each side at the exterior angle.

Length, 26–30 mm; width, 11–12 mm.

Type locality.—Guerrero, Mexico.

Type and allotype.—U.S.N.M. No. 49550.

Paratype.—In the H. E. Hinton collection.

Remarks.—Described from three examples (one female type). The type was collected at an altitude of 2,400 feet by William Schaus; the allotype is labeled "Sinaloa, Mexico"; the female paratype was collected at Tejupilco, Mexico, D.F., at an altitude of 3,960 feet, during July 1932, by H. E. Hinton. The two vague, median depressions on the pronotum of the type are entirely absent in the allotype and paratype.

This species resembles *geniculata* Théry, but it differs from that species in having the scutellum elongate triangular, the femora uniformly green, and the last abdominal segment uniformly green, with the emargination at the apex different.

COLOBOGASTER GIGAS, new species

Male.—Broadly oblong, vaguely narrowed in front and behind, and feebly convex; head and antennae green, the latter with the

outer joints bluish black on the under side; pronotum aeneo-virideous, with the median part irregularly purplish black; scutellum aeneous, with a bluish or purplish tinge; elytra uniformly purplish black; beneath green, with the tarsi and posterior margin of abdominal segments (except the first at middle) bluish black.

Head with the front flat, uneven, with an oblong, median elevation behind the epistoma, enclosing a deep, round depression between the antennal cavities, a very strongly elevated, heart-shaped elevation on the vertex, and a narrow, longitudinal groove on the occiput; surface coarsely, irregularly, confluent punctate, the punctures sparser on the heart-shaped elevation, sparsely clothed with erect, inconspicuous hairs, the intervals feebly, densely granulose; epistoma broadly, rather deeply, arcuately emarginate in front.

Pronotum moderately, uniformly convex, distinctly narrower at apex than at base, and widest at base, with a vague depression on each side near posterior angle; sides obliquely expanded from apical angles to middle, then nearly parallel to near the posterior angles, which are acute, but not projecting beyond the elytra; anterior margin transversely truncate; base broadly, deeply, arcuately emarginate at middle of each elytron, with the median lobe transversely subtruncate in front of scutellum; surface finely, densely, irregularly punctate, the intervals vaguely granulose. Scutellum triangular, acuminate at apex, the surface vaguely granulose.

Elytra wider than pronotum at base, and slightly wider at base than behind middle; humeral angles broadly rounded; sides nearly parallel or feebly narrowed from base to near the tips, which are separately broadly rounded, with a distinct tooth near middle of apex; surface very finely, rather densely, uniformly punctate, and each elytron with two or three vague, smooth, longitudinal costae, and a round, deep, basal depression.

Abdomen beneath densely, finely granulose, rather densely, finely, irregularly punctate, and sparsely clothed at sides along anterior margin of segments with long, recumbent, white pubescence; first segment broadly, longitudinally grooved at middle; last segment broadly, deeply, arcuately emarginate at apex, with a small tooth on each side along lateral margin. Prosternum strongly gibbose, vaguely granulose, sparsely, irregularly punctate, and sparsely clothed with fine, erect, white hairs; anterior margin slightly elevated; prosternal process feebly expanded posteriorly, with the apex broadly angulated.

Female.—Differs from the male in having the last abdominal segment broadly truncate at apex, with a distinct tooth on each side at external angle, and a smaller tooth along the lateral margins.

Length, 34–38 mm; width, 14–16 mm.

Type locality.—Panama, Republic of Panama.

Type, allotype, and paratype.—U.S.N.M. No. 49551.

Remarks.—Described from three examples (one male type). The type was collected by Brother G. Regis; the male paratype, labeled "Panama, 1917", is from the Wirt Robinson collection; and the allotype was collected near San Sebastian, Guatemala, by L. Thiel.

This species resembles *cyanitarsis* Castelnau and Gory, but it differs from that species in being much larger, in having the anterior margin of the epistoma deeply, arcuately emarginate, and in having the emargination at the apex of the last abdominal segment different.

PARATYNDARIS MEXICANA, new species

Male.—Robust, cylindrical, strongly acuminate posteriorly, uniformly black, with a vague purplish reflection in certain lights, and each elytron ornamented with a large, rounded, reddish-yellow basal spot, and with two similar spots along the lateral margin, one near the humerus and the other at the middle.

Head with the front nearly flat, and distinctly narrower at top than at bottom; surface coarsely, densely punctate, and densely clothed with long, semierect, whitish pubescence, which nearly conceals the surface; epistoma broadly, arcuately emarginate in front; antenna slender, very short, serrate from the sixth joint, and extending slightly beyond anterior margin of pronotum.

Pronotum globose, slightly wider than long, widest at middle, and the sides strongly, arcuately rounded; disk vaguely, longitudinally depressed on basal half; surface coarsely, densely granulate, and rather densely, uniformly clothed with rather long, semierect, white hairs. Scutellum very small, narrowly oblong, and nearly smooth.

Elytra as wide as pronotum at base, the sides feebly, arcuately expanded behind the humeral angles, then obliquely narrowed to the tips, which are separately subtruncate and very coarsely, irregularly dentate; lateral margins coarsely, irregularly dentate on apical halves; disk moderately convex, feebly, longitudinally striate, the striae punctate, intervals narrow, feebly convex, densely, rather coarsely, irregularly punctate, rather densely clothed with moderately long, semierect, white hairs, and each elytron with a longitudinal row of short, erect teeth near the lateral margin on apical half.

Abdomen beneath vaguely granulate, coarsely, densely punctate, and rather densely clothed with long, recumbent, white pubescence; third segment with a broadly rounded, smooth, median lobe on the posterior margin, the lobe projecting over the anterior part of the fourth segment; last segment long, and strongly acuminate at apex; pygidium densely granulate, and very coarsely, confluent punctate.

Length, 9.75 mm; width, 3.25 mm.

Type locality.—Los Mochis, Sinaloa, Mexico.

Type.—U.S.N.M. No. 49552.

Remarks.—Described from a unique male collected July 2, 1924, by R. W. Van Zwaluwenburg.

This species resembles *olneyae* Skinner, but it differs from that species in being more elongate, more strongly acuminate posteriorly, and by the different arrangement of the reddish-yellow spots on the elytra.

AGRILUS RUFOBRUNNEUS, new species

Female.—Rather robust, slightly flattened above, and moderately shining; above and beneath dark brown, with a distinct reddish-cupreous tinge, and each elytron ornamented with a vague, longitudinal, whitish pubescent vitta, extending from basal depression to near the apex.

Head with the front rather wide, slightly convex, about equal in width at top and bottom, lateral margins parallel, and with a broad, longitudinal depression extending from epistoma to occiput, the depression distinctly deeper and broader on the vertex and occiput; surface coarsely, deeply, irregularly rugose, the rugae more or less concentric on the occiput, sparsely punctate between the rugae, and sparsely clothed with short, semierect, white hairs; epistoma strongly transverse between the antennae, strongly elevated, and broadly, deeply, arcuately emarginate in front; antenna short, serrate from the fifth joint, the outer joints transverse; eyes rather large, and more acutely rounded beneath than above.

Pronotum about one fourth wider than long, about equal in width at base and apex, and widest at apical fourth; sides arcuately expanded from apical angles to apical fourth, then obliquely narrowed to the posterior angles, which are rectangular; when viewed from the side the marginal and submarginal carinae strongly sinuate, widely separated anteriorly but joined near the base; anterior margin strongly sinuate, with the median lobe strongly, broadly rounded; base strongly, angularly emarginate at middle of each elytron, with the median lobe broadly rounded, and transversely truncate in front of the scutellum; disk strongly convex, feebly, broadly, transversely flattened behind the middle, with a rather deep depression on each side extending obliquely forward to the lateral margin near middle, and with a rather strongly elevated, oblong swelling replacing the prehumeral carina near each posterior angle; surface coarsely, deeply, irregularly rugose, the rugae concentric on each side of the middle near anterior margin, finely, sparsely punctate between the rugae, and sparsely clothed with short, semierect, white hairs. Scutellum feebly, transversely carinate, the surface finely reticulate.

Elytra as wide as pronotum at base, and about equal in width at base and behind middle; sides parallel for a short distance behind base, broadly, arcuately constricted near middle, arcuately expanded behind middle, then obliquely narrowed to the tips, which are separately narrowly rounded, and finely serrulate; sides of abdomen broadly exposed above; disk feebly flattened, the sutural margins rather strongly elevated toward apices, and with broad, deep, basal depressions; surface densely, coarsely imbricate-punctate, each elytron ornamented with a broad, vague vitta along the sutural margin, extending from the basal depression to near the apex, and composed of sparsely placed, short, semierect, white hairs.

Abdomen beneath sparsely marked with more or less transverse, crenulate lines, which are coarser on basal segment, sparsely, finely punctate, sparsely, uniformly clothed with short, semierect, white hairs; first segment strongly convex at middle, the suture between the first and second segments not distinct at the sides; last segment broadly rounded at apex; vertical portions of segments not conspicuously pubescent; pygidium rounded at apex, coarsely punctate, and without a projecting carina. Prosternum coarsely, densely rugose, and rather densely clothed with rather long, semierect, white hairs; prosternal lobe broad, strongly declivous, and broadly, arcuately rounded in front; prosternal process broad, the sides parallel, and broadly truncate at apex. Tibiae slender, straight, and unarmed at apices. Posterior tarsi short, about one half as long as the tibiae, the first joint as long as the following two joints united. Anterior and middle tarsal claws cleft near the middle, the inner tooth much shorter than the outer one, and not turned inward. (Claws missing on posterior tarsi.)

Male.—Differs from the female in having the front of the head narrower, the prosternum densely clothed with long, erect, white hairs at the middle, the first and second abdominal segments feebly, longitudinally depressed and clothed with longer and more erect hairs at the middle, and the tarsal claws dissimilar; the anterior and middle ones deeply cleft, with the teeth acute at the tips and nearly equal in length, the posterior ones cleft near the middle, with the inner tooth broad, much shorter than the outer one, and not turned inward.

Length, 7–8 mm; width, 1.75–2 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 49553.

Allotype.—In the H. E. Hinton collection.

Remarks.—Described from a male and a female (female type) collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species resembles *illectus* Fall, but it differs from that species in having the head more deeply depressed on the occiput, the pronotum more deeply, coarsely rugose, not longitudinally depressed at the middle, and in having the prehumeral carina replaced by an oblong swelling.

AGRILUS HINTONI, new species

Female.—Robust and strongly flattened above; head aureo-aeneous, becoming reddish purple on occiput; pronotum and scutellum reddish purple, with a feeble bluish tinge and strongly shining; elytra black, opaque; beneath black, rather strongly shining.

Head with the front rather wide, flat, about equal in width at top and bottom, lateral margins parallel, with a broad, shallow, longitudinal depression extending from epistoma to occiput, and with a more or less distinct, smooth, V-shaped carina on the front; surface rather densely, coarsely, irregularly punctate, becoming transversely rugose on occiput, and sparsely clothed with moderately long, recumbent, yellow hairs; epistoma scarcely transverse between the antennae, slightly elevated, and broadly, deeply, arcuately emarginate in front; antenna short, serrate from the fourth joint, the outer joints strongly serrate and about as long as wide; eyes large, equally rounded above and beneath.

Pronotum about one third wider than long, slightly narrower at apex than at base, and widest at apical fourth; sides arcuately expanded from apical angles to apical fourth, then obliquely narrowed to the posterior angles, which are rectangular; when viewed from the side the marginal carina rather strongly sinuate, the submarginal carina feebly sinuate, the two carinae narrowly separated anteriorly but joined near the base; anterior margin strongly sinuate, with the median lobe rather strongly produced and broadly rounded; base transversely truncate to the middle of each elytron, with the median lobe strongly produced and very broadly rounded; disk strongly convex anteriorly, broadly depressed on basal half, the depression extending obliquely forward on each side to the apical angle, with a rounded swelling replacing the prehumeral carina near each posterior angle, and with a small, round, deep fovea between the swelling and basal margin; surface coarsely but not very deeply, irregularly rugose, the rugae concentric on the convex area, finely, sparsely punctate between the rugae, sparsely clothed with short, inconspicuous hairs, and densely clothed in the depressions with long, recumbent, golden-yellow pubescence, which conceals the surface. Scutellum longitudinally depressed, without transverse carina, the surface finely, densely reticulate.

Elytra slightly wider than pronotum at base, subequal in width at base and behind middle; sides slightly expanded behind base,

broadly, arcuately constricted in front of middle, arcuately expanded behind middle, then arcuately narrowed to the tips, which are separately narrowly rounded and finely serrulate; sides of abdomen only vaguely exposed above; disk rather strongly flattened, the sutural margins feebly elevated behind the middle, and with broad, moderately deep, basal depressions; surface very finely, densely imbricate-punctate, sparsely, uniformly clothed with short, inconspicuous hairs.

Abdomen beneath finely, densely granulose, sparsely, feebly punctate, with transverse, crenulate lines, which are coarser on basal segment, sparsely, uniformly clothed with short, recumbent, white hairs, and ornamented with long, recumbent, golden-yellow pubescence as follows: A rather broad vitta along the lateral margins of the first and second segments, and a large spot on each side near lateral margin on the third and fourth segments; first segment strongly convex at middle, the suture between the first and second segments not distinct at the sides; last segment broadly rounded at apex; vertical portions of segments not conspicuously pubescent; pygidium coarsely, densely punctate, longitudinally carinate, but the carina not projecting at apex. Prosternum densely, coarsely rugose, sparsely clothed with rather short, semierect, white hairs on the median part, and densely clothed at the sides with long, recumbent, golden-yellow pubescence; prosternal lobe broad, strongly declivous, rather deeply, broadly, arcuately emarginate in front; prosternal process broad, the sides parallel to behind the coxal cavities, then arcuately narrowed to the apex, which is acutely rounded. Mesosternum and metasternum clothed at the sides with long, recumbent, golden-yellow pubescence. Tibiae slender, straight, unarmed at apices. Posterior tarsi short, about one half as long as tibiae, the first joint as long as the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth broader and shorter than the outer one, and not turned inward.

Length, 9–9.5 mm; width, 2.25–2.5 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type and paratype.—U.S.N.M. No. 49554.

Paratypes.—In the H. E. Hinton collection.

Remarks.—Described from five females (one type) collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species resembles *opacipennis* Waterhouse, but it differs from that species in having the golden-yellow pubescence extending over the basal half of the pronotum, and in having a round swelling replacing the prehumeral carina.

AGRILUS MEGERLEI, new species

Male.—Elongate, slightly flattened above, strongly shining, uniformly olivaceous-green above and beneath.

Head with the front rather narrow, slightly convex, feebly narrower at top than at bottom, lateral margins feebly, obliquely converging from bottom to top, and with a shallow, longitudinal depression extending from occiput to epistoma, the depression becoming triangular on lower half of front; surface coarsely, irregularly, but not deeply rugose, sparsely, coarsely punctate, with a small, smooth spot on each side of middle near bottom, and sparsely clothed with short, recumbent, whitish hairs; epistoma rather strongly transverse between the antennae, slightly elevated, broadly, arcuately emarginate in front, and the surface deeply depressed; antenna short, serrate from the fourth joint, the outer joints triangular, and about as long as wide; eyes large, equally rounded above and beneath.

Pronotum about one fourth wider than long, about equal in width at base and apex, and widest at apical fourth; sides nearly parallel from apical angles to posterior angles, which are rectangular; when viewed from the side the marginal carina feebly sinuate, the submarginal carina straight, the two carinae narrowly separated anteriorly but joined behind the middle; anterior margin strongly sinuate, with the median lobe strongly produced, and broadly rounded; base transversely truncate to middle of each elytron, with the median lobe slightly produced and broadly rounded; disk moderately convex anteriorly, feebly, transversely flattened on basal half, with a deep depression on each side extending obliquely backward from the lateral margin at apical third to the flattened basal area, and with a round swelling, which is slightly carinate, near the posterior angles; surface feebly, irregularly rugose, the rugae shallow, widely separated, and more or less concentric on the convex area, sparsely, rather coarsely punctate between the rugae, and sparsely clothed with short, semierect, inconspicuous hairs. Scutellum without a transverse carina, the surface finely, densely reticulate.

Elytra slightly wider than pronotum at base, subequal in width at base and behind middle; sides slightly expanded behind base, broadly, arcuately constricted in front of middle, arcuately expanded behind middle, then arcuately narrowed to the tips, which are separately narrowly rounded and finely serrulate; sides of abdomen not exposed above; disk rather strongly flattened along sutural margins, with a vague, longitudinal costa on each elytron at middle, the sutural margins scarcely elevated, and with broad, deep, basal depressions; surface finely, densely imbricate-punctate, and sparsely, uniformly clothed with short, semierect, yellowish hairs.

Abdomen beneath vaguely granulose, rather densely marked with fine, transverse, crenulate lines, which are denser on basal segments, rather densely, finely punctate, and sparsely, uniformly clothed with short, recumbent, white hairs; first segment convex at middle, the suture between the first and second segments not distinct at the sides; last segment broadly rounded at apex; vertical portions of segments not conspicuously pubescent; pygidium densely, coarsely punctate, without a projecting carina at apex. Prosternum feebly rugose, sparsely, coarsely punctate, and sparsely clothed with short, recumbent, white hairs; prosternal lobe broad, strongly declivous, and broadly, rather deeply, arcuately emarginate in front; prosternal process broad, the sides parallel to behind the coxal cavities, then obliquely narrowed to the apex, which is acute. Tibiae slender, nearly straight, the anterior and middle pairs armed with a small tooth on inner margin at apices. Posterior tarsi distinctly shorter than tibiae, the first joint as long as the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth broad, distinctly shorter than outer one, and not turned inward.

Female.—Similar to the male but the tibiae not armed with a tooth at apices.

Length, 4.5–7.75 mm; width, 1.2–1.8 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type and paratypes.—U.S.N.M. No. 49555.

Paratypes.—In the H. E. Hinton collection.

Remarks.—Described from eight examples (one male type) collected at the type locality at an altitude of 3,960 feet, during July 1932 by H. E. Hinton.

This species is allied to *consobrinus* Dugès, but it differs from that species in being uniformly olivaceous-green above, with the elytra uniformly pubescent, and the pronotum without a median depression. The small series of specimens examined show considerable variation in size, and in some of these examples the upper surface has a distinct golden-green tinge.

AGRILUS SILVICOLA, new species

Female.—Rather robust, flattened above, strongly shining; head, pronotum, and scutellum reddish cupreous; elytra black, with a feeble purplish tinge; beneath aeneous, with a distinct greenish reflection.

Head with the front rather wide, slightly convex, about equal in width at top and bottom, lateral margins parallel, and with a shallow, longitudinal depression extending from occiput to epistoma, the depression distinctly broader on the lower half of the front; surface coarsely, irregularly, but not deeply rugose, coarsely, sparsely punc-

tate, with a more or less distinct, small, smooth spot on each side of middle near bottom, and sparsely clothed with short, recumbent, white hairs; epistoma slightly transverse between the antennae, slightly elevated, broadly, feebly, arcuately emarginate in front, and the surface feebly depressed; antenna short, serrate from the fourth joint, and the outer joints transverse; eyes large, and about equally rounded above and beneath.

Pronotum about two fifths wider than long, subequal in width at base and apex, and widest at apical third; sides feebly, arcuately rounded from apical angles to posterior angles, which are rectangular; when viewed from the side the marginal carina feebly sinuate, the submarginal carina straight, the two carinae narrowly separated anteriorly but joined behind the middle; anterior margin strongly sinuate, with the median lobe strongly produced and broadly rounded; base transversely truncate to middle of each elytron, with the median lobe slightly produced and broadly rounded; disk moderately convex anteriorly, feebly, transversely flattened on basal half, with a broad, moderately deep depression on each side extending obliquely backward from the lateral margin at apical third to the flattened basal area, and with a round swelling replacing the prehumeral carina near each posterior angle; surface feebly, irregularly rugose, the rugae shallow, widely separated, and more or less concentric on the convex area, sparsely, rather coarsely punctate between the rugae, and sparsely clothed with short, semierect, inconspicuous hairs. Scutellum without a transverse carina, the surface finely, densely reticulate.

Elytra slightly wider than pronotum at base, narrower at base than at apical fourth; sides feebly expanded behind the base, broadly, arcuately constricted in front of middle, strongly, arcuately expanded behind middle, then arcuately narrowed to the tips, which are separately narrowly rounded and finely serrulate; sides of abdomen not exposed above; disk rather strongly flattened along sutural margins, which are scarcely elevated, with a vague, longitudinal costa on each elytron at middle, and with broad, deep, basal depressions; surface finely, densely imbricate-punctate, and sparsely, uniformly clothed with distinct, short, semierect, white hairs.

Abdomen beneath vaguely granulose, rather densely marked with fine, transverse, crenulate lines, somewhat scabrous at sides of basal segments, finely, rather densely punctate, and sparsely, uniformly clothed with short, recumbent, white hairs; first segment convex at middle, suture between first and second segments not distinct at the sides; last segment broadly rounded at apex; vertical portions of segments not conspicuously pubescent; pygidium densely, coarsely punctate, without a projecting carina at apex. Prosternum feebly rugose, sparsely, coarsely punctate, and sparsely clothed with short,

recumbent, white hairs; prosternal lobe broad, strongly declivous, and broadly, rather deeply, arcuately emarginate in front; prosternal process broad, the sides parallel to behind the coxal cavities, then obliquely narrowed to the apex, which is acute. Tibiae slender, nearly straight, unarmed at apices. Posterior tarsi about one half as long as tibiae, the first joint as long as the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth broad, distinctly shorter than the outer one, and not turned inward.

Length, 5.25-7 mm; width, 1.3-1.75 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 49556.

Paratypes.—In the H. E. Hinton collection.

Remarks.—Described from three females (one type) collected at the type locality, at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species is allied to *megerlei* Fisher, but it differs from that species in having the head, pronotum, and scutellum reddish-cupreous or aureous, and the elytra black, with a feeble purplish tinge. The species varies considerably in size, and in the paratypes the sides of the pronotum are more obliquely narrowed posteriorly than in the type. The anterior and posterior tarsal claws are missing on the type.

AGRILUS RESPLENDENS, new species

Female.—Moderately elongate, robust, feebly narrowed posteriorly, strongly flattened above, rather strongly shining, uniformly greenish blue above and beneath.

Head with the front wide, rather strongly convex, distinctly wider at top than at bottom, lateral margins obliquely converging from top to bottom, and rather deeply, broadly concave, the concavity extending from occiput to epistoma; surface feebly, coarsely rugose, coarsely, densely punctate, sparsely clothed with short, erect, inconspicuous hairs; epistoma strongly transverse between the antennae, moderately elevated, broadly, rather deeply, arcuately emarginate in front, the surface deeply, triangularly depressed; antenna short, serrate from the fourth joint, the outer joints triangular and about as long as wide; eyes large, equally rounded above and beneath.

Pronotum nearly one half wider than long, subequal in width at base and apex, and widest near apical third; sides feebly, arcuately rounded anteriorly, more obliquely narrowed to the posterior angles, which are rectangular; when viewed from the side the marginal carina is arcuate, the submarginal carina strongly sinuate, the two carinae widely separated anteriorly, and connected to each other at the base; anterior margin strongly sinuate, with the median lobe

slightly produced and broadly rounded; base transversely truncate to middle of each elytron, with the median lobe strongly produced and broadly rounded; disk moderately convex, with a broad, longitudinal, median depression extending from apex to base, a broad, oblique depression on each side at lateral margin, a large, round swelling replacing the prehumeral carina near each posterior angle, and with a round, deep fovea between the swelling and basal margin; surface vaguely rugose toward the sides, rather densely, coarsely, irregularly punctate, and sparsely clothed with short, inconspicuous hairs. Scutellum depressed at middle, without a transverse carina, the surface densely, finely reticulate.

Elytra as wide as pronotum at base, slightly narrower at base than behind middle; sides slightly expanded behind base, broadly, arcuately constricted at middle, arcuately expanded behind middle, then arcuately narrowed to the tips, which are separately narrowly rounded and feebly serrulate; sides of abdomen narrowly exposed above; disk slightly flattened, the sutural margins slightly elevated posteriorly, with broad, deep, basal depressions, and two rather distinct, smooth, longitudinal costae on each elytron, the costae not extending to the base or apex; surface densely, coarsely imbricate-punctate, nearly glabrous.

Abdomen beneath vaguely granulose, rather coarsely, sparsely punctate, densely marked with transverse, crenulate lines toward the sides of basal segments, and sparsely, uniformly clothed with short, inconspicuous, white hairs; first segment convex at middle, the suture between the first and second segments distinct at the sides; last segment broadly rounded at apex; vertical portions of the segments densely clothed with long, whitish pubescence; pygidium densely, coarsely punctate, and without a projecting carina at apex. Prosternum vaguely granulose, sparsely, coarsely punctate, sparsely clothed with moderately long, semierect, white hairs, the surface deeply, narrowly, transversely depressed behind the prosternal lobe, which is broad, strongly declivous, and broadly, rather deeply, arcuately emarginate in front; prosternal process broad, the sides parallel to behind the coxal cavities, then obliquely narrowed to the apex, which is acute. Tibiae slightly flattened, anterior pair slightly arcuate, and all pairs unarmed at apices. Posterior tarsi nearly as long as the tibiae, the first joint as long as the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth slightly broader and distinctly shorter than the outer one, and not turned inward.

Length, 10–11.5 mm; width, 3.75–4 mm.

Type locality.—Temascaltepec, Mexico, D.F.

Type.—U.S.N.M. No. 49557.

Paratypes.—In the H. E. Hinton collection.

Remarks.—Described from three females (one type) collected at the type locality during 1931 by G. B. Hinton.

This species is allied to *phaenicopterus* Waterhouse, but it differs from that species in being uniformly greenish blue, while the head is without golden pubescence in front, and the prosternal lobe is rather deeply emarginate in front.

AGRILUS PROXIMULUS, new species

Male.—Elongate, slender, rather strongly flattened above, feebly shining; head green, becoming brownish on the occiput; pronotum, elytra, and beneath uniformly black.

Head with the front rather wide, nearly flat, about equal in width at top and bottom, lateral margins nearly parallel, vaguely expanded at bottom, and vaguely, broadly, longitudinally depressed; surface densely granulose, very coarsely, deeply, confluent punctate, and nearly glabrous; epistoma narrow between the antennae, not elevated, but feebly, broadly, arcuately emarginate in front; antenna short, serrate from the fifth joint, the outer joints slightly transverse and compact; eyes large, oval, and equally rounded above and beneath.

Pronotum slightly wider than long, wider at apex than at base, and widest near apex; sides feebly, arcuately narrowed from apex to posterior angles, which are rectangular; when viewed from the side the marginal and submarginal carinae sinuate, narrowly separated anteriorly but joined behind the middle; anterior margin strongly sinuate, the median lobe strongly produced and broadly rounded; base strongly, angularly emarginate at middle of each elytron, with the median lobe moderately produced and broadly rounded; disk strongly convex, feebly, transversely depressed on basal half, the depression extending on each side along the lateral margin but becoming narrower toward the apical angle, with a vague, longitudinal, median depression indicated in front and behind the middle, and with sharply defined, arcuate prehumeral carinae, extending to middle of pronotum but not connected to the marginal carinae; surface feebly, densely granulose, coarsely but not deeply rugose, the rugae widely separated and more or less transverse on the disk, finely, sparsely punctate between the rugae, and glabrous. Scutellum transversely carinate, the surface finely, densely granulose.

Elytra as wide as pronotum at base, subequal in width at base and behind middle; sides parallel for a short distance behind base, broadly, arcuately constricted in front of middle, broadly, arcuately expanded behind middle, then obliquely narrowed to the tips, which are separately narrowly rounded and rather coarsely serrate; sides of abdomen narrowly exposed above; disk feebly flattened along sutural margins, which are strongly elevated posteriorly, and with broad, deep, basal depressions; surface densely, finely imbricate.

cate-punctate, sparsely clothed with short, inconspicuous, white hairs toward apices.

Abdomen beneath sparsely marked with transverse, crenulate lines, imbricate-punctate at sides of basal segment, finely, sparsely punctate on the other segments, and sparsely, uniformly clothed with short, recumbent, white hairs; first segment convex at middle, the suture between the first and second segments vaguely indicated at the sides; last segment broadly rounded at apex; vertical portions of the segments not conspicuously pubescent; pygidium coarsely punctate, longitudinally carinate, but the carina not projecting at apex. Prosternum sparsely, finely punctate, and rather densely clothed with long, semierect, white hairs at middle; prosternal lobe broad, strongly declivous, broadly subtruncate in front; prosternal process rather broad, the sides parallel to behind the coxal cavities, then narrowed to the apex, which is acute. Tibiae slender, the anterior and middle pairs slightly arcuate and armed with a small tooth on inner margin at apices. Posterior tarsi nearly as long as the tibiae, the first joint as long as the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth broad, distinctly shorter than the outer one, and not turned inward.

Length, 4.3–4.5 mm; width, 1 mm.

Type locality.—Real de Arriba, Mexico, D.F.

Type.—U.S.N.M. No. 49558.

Paratype.—In the H. E. Hinton collection.

Remarks.—Described from two examples, probably both males (one type), collected at the type locality at an altitude of 6,300 feet, during July 1932, by H. E. Hinton.

This species resembles *nigripennis* Waterhouse, but it differs from that species in being uniformly black above, in having the antenna serrate from the fifth joint, and the inner tooth of the tarsal claws not turned inward and not touching the tooth on the opposite side.

AGRILUS TINCTIPENNIS, new species

Female.—Elongate, slender, rather strongly flattened above, rather strongly shining; head aeneo-cupreous; pronotum, elytra, and beneath black, with a vague purplish reflection in certain lights, the elytra with the humeral angles cupreous.

Head with the front broad, feebly convex, slightly wider at the top than at the bottom, lateral margins feebly, obliquely converging from top to bottom, and vaguely, longitudinally depressed; surface coarsely but not deeply, irregularly rugose, coarsely, sparsely punctate between the rugae, and sparsely clothed with short, inconspicuous hairs; epistoma transverse between the antennae, strongly elevated, broadly, rather deeply, arcuately emarginate in front; antenna rather long, serrate from the fifth joint, the outer joints

strongly triangular and about as wide as long; eyes rather small, oblong, slightly more acutely rounded beneath than above.

Pronotum subequal in length and width, wider at apex than at base, widest near middle; sides feebly, arcuately rounded anteriorly, obliquely narrowed posteriorly to the posterior angles, which are rectangular; when viewed from the side the marginal and submarginal carinae nearly straight, rather widely separated anteriorly, and connected to each other at the base; anterior margin strongly sinuate, the median lobe strongly produced and broadly rounded; base feebly, arcuately emarginate at middle of each elytron, with the median lobe moderately produced, and broadly rounded; disk strongly convex, feebly, transversely depressed on basal half, the depression extending on each side along lateral margin, but becoming narrower toward apical angle, with a vague, broad, median depression extending from base to near anterior margin, and with vague, short, straight prehumeral carinae; surface finely, densely granulose, coarsely but not deeply rugose, the rugae widely separated, transverse on disk, and longitudinal at sides, finely, sparsely punctate between the rugae, and sparsely clothed with short, inconspicuous hairs. Scutellum transversely carinate, the surface finely, densely reticulate.

Elytra slightly wider than pronotum at base, slightly narrower at base than behind middle; sides slightly expanded behind base, broadly, arcuately constricted at middle, broadly, arcuately expanded behind middle, then obliquely narrowed to the tips, which are separately narrowly rounded and feebly serrulate; sides of abdomen vaguely exposed above; disk slightly flattened along sutural margins, which are strongly elevated posteriorly, and with broad, deep, basal depressions; surface densely, finely imbricate-punctate, and sparsely, uniformly clothed with short, recumbent, white hairs.

Abdomen beneath feebly, sparsely marked with transverse, crenulate lines, which are coarser at sides of basal segment, finely, sparsely punctate, and sparsely clothed with short, recumbent, white hairs; first segment strongly convex at middle, the suture between first and second segments not indicated at the sides; last segment broadly rounded at apex; vertical portions of the segments not conspicuously pubescent; pygidium finely granulose, feebly, coarsely punctate, and not distinctly carinate at the middle. Prosternum densely, coarsely granulose, sparsely punctate, and sparsely clothed with short, recumbent, white hairs; prosternal lobe broad, strongly declivous, deeply emarginate in front, forming an arcuate lobe on each side; prosternal process rather wide, the sides parallel to behind the coxal cavities, then obliquely narrowed to the apex, which is acute. Tibiae slender and unarmed at apices. Posterior tarsi slightly more than half as long as tibiae, the first joint as long as the following two joints united. Tarsal claws similar on all feet, cleft near the middle, the

inner tooth broad, distinctly shorter than outer one, and not turned inward.

Length, 4–4.5 mm; width, 1–1.25 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 49559.

Paratype.—In the H. E. Hinton collection.

Remarks.—Described from two females (one type) collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species is allied to *proximus* Fisher, but it differs from that species in having the humeral angles of the elytra cupreous, the pre-humeral carinae on the pronotum feebly elevated, and the prosternal lobe deeply emarginate at the middle and forming an arcuate lobe on each side. The paratype differs slightly from the type in having the pronotum more deeply, longitudinally depressed.

AGRILUS PICEOLUS, new species

Male.—Elongate, slender, rather strongly flattened above, and rather strongly shining; head aeneo-virideous, becoming cupreous on the occiput; pronotum, elytra, and beneath black, with a vague purplish reflection in certain lights, each elytron ornamented with a vague, whitish pubescent vitta, extending along the sutural margin from basal depression to apex.

Head with the front rather narrow, feebly convex, slightly wider at top than at the bottom, lateral margins feebly, arcuately constricted on lower half, and without distinct depressions; surface coarsely, deeply, irregularly rugose, sparsely, finely punctate between the rugae, and sparsely clothed with short, recumbent, white hairs behind the epistoma; epistoma narrow between the antennae, not elevated, and deeply but not broadly, arcuately emarginate in front; antenna rather short, serrate from the fourth joint, the outer joints triangular and about as long as wide; eyes large, strongly oblong, and about equally rounded above and beneath.

Pronotum slightly wider than long, about equal in width at base and apex, and widest in front of middle; sides strongly, arcuately rounded anteriorly, more obliquely narrowed posteriorly to the posterior angles, which are rather acute; when viewed from the side the marginal and submarginal carinae strongly sinuate, narrowly separated anteriorly, and connected to each other behind the middle; anterior margin strongly sinuate, the median lobe moderately produced and broadly rounded; base strongly, arcuately emarginate at middle of each elytron, with the median lobe rather strongly produced and broadly rounded; disk moderately convex, feebly, transversely depressed on basal half, the depression extending on each side along lateral margin, but becoming narrower toward apical

angle, with a vague, median depression extending from base to near anterior margin, and with sharply defined, arcuate, prehumeral carina, the carina close to lateral margin and connected to it near the middle; surface coarsely but not deeply rugose, the rugae transverse on disk, finely, sparsely punctate between the rugae, and nearly glabrous. Scutellum strongly, transversely carinate, the surface finely, densely reticulate.

Elytra about as wide as pronotum at base, subequal in width at base and behind middle; sides slightly expanded behind base, broadly, arcuately constricted in front of middle, broadly, arcuately expanded behind middle, then obliquely narrowed to the tips, which are separately narrowly rounded and rather coarsely serrulate; sides of abdomen broadly exposed above; disk rather strongly flattened along sutural margins, which are feebly elevated posteriorly, and with broad, moderately deep, basal depressions; surface densely, finely imbricate-punctate, each elytron ornamented with a narrow vitta of sparse, short, white hairs extending along the sutural margin from basal depression to apex.

Abdomen beneath densely marked with transverse, crenulate lines, which are coarser at sides of basal segment, finely, sparsely punctate, and sparsely, uniformly clothed with short, recumbent, white hairs, which are longer and more erect on apical segment; first segment strongly convex at middle, the suture between first and second segments not indicated at the sides; last segment broadly rounded at apex; vertical portions of the segments not conspicuously pubescent; pygidium sparsely, coarsely punctate, longitudinally carinate, but the carina not projecting at apex. Prosternum feebly rugose, sparsely punctate, and sparsely clothed with moderately long, semi-erect, white hairs; prosternal lobe broad, strongly declivous, broadly subtruncate or vaguely emarginate in front; prosternal process broad, the sides parallel to behind the coxal cavities, then subtruncate to the median tooth, which is acute. Tibiae slender, the anterior and middle pairs armed with a small tooth on inner margin at apices. Posterior tarsi more than one half as long as the tibiae, the first joint as long as the following two joints united. Tarsal claws similar on all feet, cleft near the middle, the teeth subequal in length, slender, acute at tips, the inner one turned inward and the tip nearly touching that of the opposite side.

Length, 5.75–6.5 mm; width, 1.3–1.5 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 49560.

Paratype.—In the H. E. Hinton collection.

Remarks.—Described from two males (one type) collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species resembles *nigripennis* Waterhouse, but it differs from that species in being uniformly black above, and in having each elytron ornamented with a vague, longitudinal, white pubescent vitta.

AGRILUS PRODIGIOSUS, new species

Female.—Elongate, slender, rather strongly flattened above, and moderately shining; head brown, with a vague cupreous tinge; pronotum aureo-cupreous; elytra violaceous-black; beneath black, with a vague cupreous tinge.

Head with the front wide, feebly convex, about equal in width at top and bottom, lateral margins parallel, and vaguely, broadly, longitudinally depressed; surface coarsely, rather deeply, confluent rugose. the rugae transverse on occiput, rather densely, coarsely punctate between the rugae, and nearly glabrous; epistoma rather narrow between the antennae, slightly elevated, and deeply but not broadly, arcuately emarginate in front; antenna rather short, serrate from the fifth joint, the outer joints triangular and about as long as wide; eyes large, oblong, and about equally rounded above and beneath.

Pronotum subequal in length and width, equal in width at base and apex, and widest at middle; sides arcuately rounded from apical angles to posterior angles, which are rectangular; when viewed from the side the marginal and submarginal carinae nearly straight, rather widely separated anteriorly, and connected to each other at the base; anterior margin strongly sinuate, the median lobe strongly produced, and broadly rounded; base strongly, arcuately emarginate at middle of each elytron, with the median lobe moderately produced and broadly rounded; disk strongly convex, with a rather deep, broad, median depression extending from base to near the anterior margin, and with vague, short, arcuate prehumeral carinae; surface very coarsely, deeply, transversely rugose, the rugae widely separated and more or less interrupted, finely, sparsely punctate between the rugae, and glabrous. Scutellum feebly, transversely carinate, the surface finely, densely reticulate.

Elytra slightly wider than pronotum at base, subequal in width at base and behind middle; sides slightly expanded behind base, broadly, arcuately constricted near middle, broadly, arcuately expanded behind middle, then arcuately narrowed to the tips, which are separately broadly rounded and rather coarsely serrulate; sides of abdomen narrowly exposed above; disk feebly flattened along sutural margins, which are strongly elevated near apices, and with broad, deep, basal depressions; surface rather coarsely, densely imbricate-punctate, sparsely clothed with short, recumbent, white hairs, which form a more or less distinct vitta along flattened area on each elytron and are uniformly distributed over apical third.

Abdomen beneath densely, coarsely marked with transverse, crenulate lines, rather densely, coarsely punctate, and rather densely, uniformly clothed with short, recumbent, white hairs; first segment convex at middle, the suture between the first and second segments not indicated at the sides; last segment broadly rounded at apex; vertical portions of the segments not conspicuously pubescent; pygidium sparsely, coarsely punctate, longitudinally carinate, but the carina not projecting at apex. Prosternum densely, coarsely granulate, sparsely punctate, and sparsely clothed with moderately long, semierect, white hairs; prosternal lobe broad, strongly declivous, and broadly subtruncate or vaguely emarginate in front; prosternal process rather wide, the sides feebly, obliquely narrowed to behind the coxal cavities, then strongly narrowed to the apex, which is acute. Tibiae slender and unarmed at apices. Posterior tarsi about three fourths as long as the tibiae, the first joint as long as the following two joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth broad, shorter than outer one, and not turned inward.

Length, 5.75 mm; width, 1.25 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 49561.

Remarks.—Described from a unique female collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species is allied to *chalcoderes* Chevrolat, but it differs from that species in having the pronotum strongly convex, longitudinally depressed at the middle, the surface coarsely rugose, with the rugae more or less interrupted, and with the prehumeral carinae only feebly indicated.

AGRILUS AZTECUS, new species

Male.—Rather robust, strongly flattened above, strongly shining, uniformly cupreous above and beneath, with the head feebly aureous in front, and each elytron ornamented with three vague, yellowish-white, pubescent spots.

Head with the front broad, feebly convex, distinctly wider at top than at bottom, lateral margins strongly, obliquely converging from top to bottom, and broadly, deeply, longitudinally depressed from epistoma to occiput; surface coarsely, deeply, irregularly rugose posteriorly, coarsely, deeply, confluent punctate anteriorly, and sparsely clothed with long, recumbent, yellowish-white hairs; epistoma rather narrow between the antennae, feebly elevated, and broadly, deeply, arcuately, emarginate in front; antenna rather short, serrate from the fifth joint, the outer joints strongly triangular, and about as wide as long; eyes large, strongly oblong, and equally rounded above and beneath.

Pronotum one third wider than long, subequal in width at base and apex, and widest at apical fourth; sides slightly rounded near apical angles, then obliquely narrowed to the posterior angles, which are rectangular; when viewed from the side the marginal and submarginal carinae feebly sinuate, narrowly separated anteriorly but joined behind the middle; anterior margin rather strongly sinuate, the median lobe feebly produced and broadly rounded; base feebly, arcuately emarginate at middle of each elytron, with the median lobe moderately produced and broadly rounded; disk moderately convex, broadly, longitudinally depressed at middle, the depression extending from base to anterior margin, and broader and deeper in front of scutellum, broadly depressed on each side along lateral margin at middle, and with rather distinct, slightly sinuate prehumeral carinae, which extend obliquely forward and are connected with the lateral margin near apical angle; surface densely, deeply, irregularly rugose, the rugae more or less transverse on disk, finely, sparsely punctate between the rugae, and sparsely clothed with short, semi-erect, yellowish-white hairs. Scutellum feebly, transversely carinate, the surface feebly reticulate.

Elytra about as wide as pronotum at base, and at base slightly wider than behind middle; sides slightly expanded behind base, broadly, arcuately constricted in front of middle, broadly, arcuately expanded behind middle, then arcuately narrowed to the tips, which are separately narrowly rounded and feebly serrulate; sides of abdomen broadly exposed above; disk feebly flattened along sutural margins, which are slightly elevated toward apices, and with broad, deep, basal depressions; surface finely, densely imbricate-punctate, vaguely, transversely rugose, sparsely clothed with short, semierect, yellowish-white hairs, and each elytron vaguely ornamented along sutural margin with three yellowish-white pubescent spots, one in basal depression, one at basal third, and the other at apical third.

Abdomen beneath sparsely marked with transverse, crenulate lines, which are denser and coarser at sides of basal segment, finely, sparsely punctate, and sparsely clothed with short, recumbent, white hairs on median part, and with longer, denser hairs toward sides of segment; first segment vaguely, longitudinally depressed at middle, the suture between first and second segments not indicated at the sides; last segment broadly rounded at apex; vertical portions of the segments rather densely clothed with recumbent, yellowish-white pubescence; pygidium sparsely, coarsely punctate, and without a distinct longitudinal carina. Prosternum more or less transversely rugose, finely, densely punctate, and sparsely clothed with long, erect, white hairs; prosternal lobe broad, strongly declivous, broadly subtruncate or vaguely emarginate in front; pro-

sternal process broad, the sides parallel to behind the coxal cavities, then subtruncate to the median tooth, which is acute. Tibiae slender and unarmed at apices. Posterior tarsi slightly shorter than the tibiae, the first joint as long as the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the teeth slender and acute at tips, about equal in length, and the inner one turned inward.

Female.—Differs from the male in having the first abdominal segment strongly convex at middle and the prosternum without long, erect, white hairs.

Length, 7.5–9.75 mm; width, 2–2.5 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type and paratypes.—U.S.N.M. No. 49562.

Paratypes.—In the H. E. Hinton collection.

Remarks.—Described from nine examples (one male type). The type and seven paratypes were collected at the type locality at an altitude of 3,960 feet, during July 1903, by H. E. Hinton, and one paratype was collected at Real de Arriba, Mexico, D.F., at an altitude of 6,300 feet, July 16, 1932, by the same collector.

This species is allied to *bicarinatus* Waterhouse, but it differs from that species in having the posterior angles of the pronotum rectangular, the prehumeral carinae connected to the lateral margins, and the pubescent spots on the elytra differently placed.

AGRILUS VELASCO, new species

Male.—Rather robust, rather strongly flattened above, and strongly shining; head aeneo-virideous, opaque; pronotum and elytra reddish cupreous; beneath brownish cupreous, with a vague aeneous or virideous tinge.

Head with the front rather wide, flat, wider at top than at bottom, lateral margins parallel on upper half, distinctly, broadly, arcuately constricted on lower half, and broadly, longitudinally depressed on vertex and occiput; surface densely, finely granulose, feebly, coarsely, irregularly rugose, coarsely, sparsely punctate, and rather densely clothed with moderately long, semierect, white hairs; epistoma rather wide between the antennae, feebly elevated, and very broadly, deeply, arcuately emarginate in front; antenna moderately long, serrate from the fifth joint, the outer joints triangular, rather compact, and about as long as wide; eyes large, strongly oblong, and about equally rounded above and beneath.

Pronotum slightly wider than long, feebly wider at apex than at base, and widest near middle; sides parallel anteriorly, obliquely narrowed behind the middle to the posterior angles, which are rectangular; when viewed from the side the marginal and submarginal carinae feebly sinuate, narrowly separated anteriorly, and connected

to each other near the base; anterior margin strongly sinuate, the median lobe rather strongly produced and broadly rounded; base angularly emarginate at middle of each elytron, with the median lobe moderately produced, and broadly subtruncate in front of scutellum; disk rather strongly convex, broadly depressed at the sides posteriorly, without distinct median depressions, but with sharply defined, straight prehumeral carinae, extending forward to near middle of pronotum; surface densely, finely, deeply, irregularly rugose, rather densely, finely punctate between the rugae, and sparsely, uniformly clothed with short, semierect, white hairs. Scutellum not transversely carinate, but with the surface feebly reticulate.

Elytra about as wide as pronotum at base, subequal in width at base and behind middle; sides slightly expanded behind base, broadly, arcuately constricted in front of middle, broadly, arcuately expanded behind middle, then obliquely narrowed to the tips, which are separately rather broadly rounded and coarsely serrulate; sides of abdomen rather broadly exposed above; disk feebly flattened along the sutural margins, which are rather strongly elevated behind the middle, and with broad, deep, basal depressions; surface densely, finely imbricate-punctate, and sparsely clothed with short, inconspicuous hairs.

Abdomen beneath densely, finely granulose, finely, densely marked with transverse, crenulate lines, finely, rather densely punctate, and sparsely, uniformly clothed with moderately long, recumbent, whitish hairs; first segment broadly, longitudinally depressed at middle, the suture between first and second segments not indicated at the sides; last segment broadly rounded at apex; vertical portions of the segments rather densely clothed with recumbent, yellowish-white pubescence; pygidium sparsely, coarsely punctate, longitudinally carinate, but the carina not projecting at apex. Prosternum densely granulose, more or less transversely rugose, finely, sparsely punctate, and sparsely clothed with moderately long, semierect, white hairs; prosternal lobe broad, moderately declivous, and broadly, arcuately rounded in front; prosternal process broad, the sides parallel to behind the coxal cavities, then broadly subtruncate to the median tooth, which is acute. Tibiae slender, slightly arcuate, each one of the anterior and middle pairs armed with a small tooth on inner margin at apex. Posterior tarsi slightly longer than tibiae, the first joint as long as the following two joints united. Tarsal claws dissimilar, anterior and middle pairs cleft near the tip, the teeth acute and nearly equal in length; posterior pair cleft near middle, the inner tooth shorter than the outer one, and not turned inward.

Female.—Differs from the male in having front of head broader and cupreous, the tibiae unarmed at apices, the first abdominal segment strongly convex at middle, and the tarsal claws similar on all

feet, cleft near the middle, the inner tooth short, and not turned inward.

Length, 7-7.75 mm; width, 1.75-2 mm.

Type locality.—Tejupileo, Mexico, D.F.

Type and paratypes.—U.S.N.M. No. 59563.

Paratypes.—In the H. E. Hinton collection.

Remarks.—Described from 10 examples (one type) collected at the type locality at an altitude of 3,960 feet, during July 1932 by H. E. Hinton.

This species is allied to *carinifer* Waterhouse, but it differs from that species in having the pronotum convex at the middle, the elytra uniformly reddish cupreous, with the tips broadly rounded and not dilated.

AGRILUS INFIDELIS, new species

Male.—Small, slender, moderately flattened above, strongly shining; head dark green, with a slight aeneous tinge, opaque; pronotum and elytra reddish cupreous, each elytron ornamented with a vague, whitish pubescent spot at apical third; beneath brownish cupreous, with a more or less distinct aeneous or virideous tinge.

Head with the front wide, nearly flat, equal in width at top and bottom, lateral margins parallel posteriorly, broadly, arcuately constricted on lower half, and without distinct depressions; surface densely, finely granulate, feebly, irregularly rugose, finely, sparsely punctate, clothed with a few short, recumbent, white hairs; epistoma transverse between the antennae, not elevated, but broadly, deeply, arcuately emarginate in front; antenna short, serrate from the fifth joint, the outer joints slightly transverse and compact; eyes large, oblong, slightly more acutely rounded beneath than above.

Pronotum about one third wider than long, slightly narrower at base than at apex, widest near apical angles; sides obliquely narrowed from near apical angles to posterior angles, which are rectangular; when viewed from the side the marginal and submarginal carinae rather strongly sinuate, widely separated anteriorly but joined near the base; anterior margin strongly sinuate, the median lobe rather strongly produced and broadly rounded; base strongly, arcuately emarginate at middle of each elytron, with the median lobe strongly produced and broadly subtruncate in front of the scutellum; disk moderately convex, broadly depressed on each side posteriorly, without distinct median depressions, but with sharply defined, straight prehumeral carinae which extend forward to middle of pronotum; surface feebly granulate, densely but not deeply, transversely rugose, finely, sparsely punctate between the rugae, nearly glabrous. Scutellum not transversely carinate, but the surface densely, finely reticulate.

Elytra slightly wider than pronotum at base, subequal in width at base and behind middle; sides nearly parallel to behind middle (vaguely constricted in front of middle), then obliquely narrowed to the tips, which are separately narrowly rounded and finely serrulate; sides of abdomen narrowly exposed above; disk vaguely flattened along sutural margins, which are slightly elevated toward apices, and with broad, shallow, basal depressions; surface finely granulose, feebly imbricate-punctate, sparsely clothed with very short, inconspicuous hairs, each elytron ornamented with a small, vague, white pubescent spot along sutural margin at apical third.

Abdomen beneath finely, sparsely marked with transverse, crenulate lines, finely, sparsely punctate, sparsely clothed with short, recumbent, whitish hairs; first segment feebly, narrowly, longitudinally depressed at middle, the suture between first and second segments not indicated at the sides; last segment rather acutely rounded at apex; vertical portions of the segments not conspicuously pubescent; pygidium sparsely, coarsely punctate, but not distinctly longitudinally carinate. Prosternum coarsely, densely granulose, densely clothed with long, semierect, white hairs at middle; prosternal lobe broad, feebly declivous, broadly, arcuately rounded in front; prosternal process broad, the sides parallel to behind the coxal cavities, then broadly subtruncate to the median tooth, which is acute. Tibiae slender, the anterior and middle pairs armed with a minute tooth on inner margin at apices. Posterior tarsi slightly shorter than tibiae, the first joint as long as the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth broad, shorter than outer one, and not turned inward.

Female.—Differs from the male in having the front of the head more aeneous, the tibiae unarmed at apices, the prosternum without long, semierect hairs at the middle, and the first abdominal segment convex at the middle.

Length, 4.25–5 mm; width, 2–2.25 mm.

Type locality.—Real de Arriba, Mexico, D.F.

Type and paratypes.—U.S.N.M. No. 49564.

Paratypes.—In the H. E. Hinton collection.

Remarks.—Described from a large series of specimens (one male type) collected at the type locality at an altitude of 6,300 feet, during July 1932, by H. E. Hinton. This seems to be a common species and in many of the specimens examined the upper surface has a distinct bluish tinge, but this seems to be due to discoloration. In some of these examples the pubescent spots on the elytra are scarcely visible.

This species is allied to *errans* Waterhouse, but it differs from that species in being uniformly reddish cupreous, and in having the prehumeral carinae on the pronotum strongly elevated.

AGRILUS VINCTUS, new species

Male.—Small, rather slender, rather strongly flattened, moderately shining, and uniformly dark olivaceous-green above; beneath brownish black, with a vague cupreous or aeneous tinge.

Head with the front wide, feebly convex, slightly wider at top than at bottom, lateral margins feebly, obliquely converging from top to bottom, and broadly, feebly, longitudinally depressed from epistoma to occiput; surface coarsely but not very deeply, irregularly rugose, coarsely, sparsely punctate between the rugae, nearly glabrous; epistoma slightly transverse between the antennae, not elevated, but broadly, deeply, arcuately emarginate in front; antenna long, serrate from the fifth joint, the outer joints strongly triangular and slightly longer than wide; eyes rather small, oblong, equally rounded above and beneath.

Pronotum one fourth wider than long, slightly narrower at base than at apex, widest in front of middle; sides arcuately rounded anteriorly, strongly, obliquely narrowed posteriorly to the posterior angles, which are rectangular; when viewed from the side the marginal and submarginal carinae feebly sinuate, widely separated anteriorly but joined near the base; anterior margin strongly sinuate, the median lobe strongly produced and broadly rounded; base vaguely, arcuately emarginate at middle of each elytron, with the median lobe feebly produced and broadly rounded; disk slightly convex, feebly, broadly depressed on each side along lateral margin, with a vague, broad, longitudinal, median depression, and with feebly distinct, slightly sinuate prehumeral carinae, which extend forward to middle of pronotum; surface densely, deeply, transversely rugose, coarsely, densely punctate between the rugae, nearly glabrous. Scutellum not transversely carinate, but the surface depressed and feebly reticulate.

Elytra slightly wider than pronotum at base, subequal in width at base and behind middle; sides parallel for a short distance behind base, broadly, arcuately constricted in front of middle, broadly, arcuately expanded behind middle, then obliquely narrowed to the tips, which are separately rather broadly rounded and feebly serrulate; sides of abdomen not exposed above; disk feebly flattened along sutural margins, which are strongly elevated, and with broad, rather shallow, basal depressions; surface densely, finely imbricate-punctate, somewhat scabrous, sparsely clothed with very short, inconspicuous hairs.

Abdomen beneath feebly, finely marked with transverse, crenulate lines, finely, sparsely punctate, sparsely clothed with short, recumbent, whitish hairs; first segment narrowly, longitudinally depressed at middle, the depression densely clothed with long, erect, white hairs, the suture between first and second segments not indicated at

the sides; last segment broadly rounded at apex; vertical portions of the segments not conspicuously pubescent; pygidium vaguely granulose, without a longitudinal carina. Prosternum coarsely granulose, densely clothed with long, erect, white hairs at middle; prosternal lobe narrow, strongly declivous, very broadly, deeply, arcuately emarginate in front; prosternal process rather narrow, the sides parallel to behind the coxal cavities, then obliquely narrowed to the apex, which is acute. Tibiae slender, unarmed at apices. Posterior tarsi nearly as long as tibiae, the first joint as long as the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth broad, shorter than outer one, and not turned inward.

Female.—Differs from the male in having the front of the head cupreous, the prosternum without long, erect hairs at the middle, and the first abdominal segment convex at the middle and without long, erect hairs.

Length, 5–5.75 mm; width, 1.25–1.5 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type and paratypes.—U.S.N.M. No. 49565.

Paratypes.—In the H. E. Hinton collection.

Remarks.—Described from 11 examples (one male type) collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species resembles *raptor* Kerremans, but it differs from that species in having the head longitudinally depressed in front, the tips of the elytra broadly rounded, and the prosternal lobe broadly and deeply emarginate in front.

AGRILUS DAMPFI, new species

Male.—Small, slender, slightly flattened above, feebly shining; head pale green, becoming cupreous on occiput; pronotum purplish black, vaguely cupreous along lateral margins; elytra bluish black along sutural margins and on apical halves, reddish cupreous on basal halves toward lateral margins, ornamented with white pubescent designs; beneath black, with a more or less distinct aeneous and cupreous tinge on the median parts.

Head with the front wide, slightly convex, about equal in width at top and bottom, lateral margins parallel, vaguely, longitudinally depressed; surface coarsely, deeply rugose, the rugae transverse in front, rather densely, coarsely punctate, clothed with a few short, inconspicuous hairs; epistoma rather narrow between the antennae, not elevated, but rather deeply, arcuately emarginate in front; antennae short, serrate from the fifth joint, the outer joints rather compact and about as long as wide; eyes large, oblong, equally rounded above and beneath.

Pronotum slightly wider than long, wider at apex than at base, and widest in front of middle; sides arcuately rounded anteriorly, obliquely narrowed posteriorly to the posterior angles, which are rectangular; when viewed from the side the marginal and submarginal carinae feebly sinuate, rather widely separated for their entire length; anterior margin strongly sinuate, with the median lobe very strongly produced and broadly rounded; base vaguely, broadly, arcuately emarginate on each side, with the median lobe slightly produced and broadly rounded; disk strongly convex anteriorly, broadly, transversely concave on basal half, the concavity extending obliquely forward on each side to the apical angle; surface feebly, coarsely, irregularly rugose, the rugae more or less transverse at the middle and oblique toward the sides, sparsely, finely punctate between the rugae, sparsely clothed toward the sides with short, white hairs. Scutellum strongly, transversely carinate, the surface densely, finely reticulate.

Elytra slightly wider than pronotum at base, and at base slightly wider than behind middle; sides arcuately rounded behind base, broadly, arcuately constricted in front of middle, broadly, arcuately expanded behind middle, then obliquely narrowed to the tips, which are separately broadly rounded or subtruncate, and finely serrulate; sides of abdomen narrowly exposed above; disk feebly flattened, without distinct longitudinal costae, the sutural margins slightly elevated posteriorly, and with broad, shallow, basal depressions; surface densely, coarsely imbricate-punctate on basal halves, more feebly punctate on apical halves, each elytron ornamented with short, recumbent, white pubescence as follows: A small spot in basal depression; a small, round, spot along sutural margin at basal third; a narrow fascia extending obliquely backward from sutural margin at middle to lateral margin behind middle; and a large, subtriangular spot covering the apical third, enclosing an oblong, glabrous spot along sutural margin.

Abdomen beneath sparsely marked with transverse, crenulate lines, which are coarser on the basal segment, sparsely, finely punctate, sparsely clothed with short, inconspicuous hairs, and with a large spot of recumbent, white pubescence on each side of third segment; first segment strongly convex at middle, the suture between first and second segments not indicated at the sides; last segment broadly subtruncate or feebly emarginate at apex; vertical portions of the segments not conspicuously pubescent, except the first, which is ornamented with a white pubescent spot; pygidium densely granulose, vaguely punctate, without a projecting carina at apex. Prosternum feebly granulose, finely, sparsely punctate, sparsely clothed with long, erect, white hairs; prosternal lobe broad, strongly declivous, broadly subtruncate or broadly, vaguely emarginate in front; pro-

sternal process moderately wide, the sides feebly narrowed to the apex, which is acute. Tibiae slender, straight, the anterior and middle pairs armed with a very small tooth on inner margin at apices. Posterior tarsi slightly shorter than tibiae, the first joint as long as the following three joints united. Tarsal claws nearly similar on all feet, cleft near the middle, the inner tooth broad, shorter than outer one, and not turned inward.

Female.—Differs from the male in having the head uniformly cupreous, the prosternum without long, erect hairs, and the tibiae unarmed at apices.

Length, 4.5–5 mm; width, 1.1–1.25 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 49566.

Paratype.—In the H. E. Hinton collection.

Remarks.—Described from a male and a female (male type) collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton, and a male paratype collected at Real de Arriba, Mexico, D.F., at an altitude of 6,300 feet, during 1932 by the same collector.

This species is allied to *signatus* Waterhouse, but it differs from that species in having the elytra bluish black, with the basal halves along the lateral margins reddish cupreous, and in having a different arrangement of the white pubescent markings on the elytra.

AGRILUS SEMIOPACUS, new species

Male.—Robust, feebly attenuate posteriorly, vaguely convex above, feebly shining, uniformly greenish or bluish black above and beneath.

Head with the front wide, nearly flat, about equal in width at top and bottom, lateral margins parallel, without distinct depressions; surface coarsely, feebly, irregularly rugose, rather densely, coarsely punctate, rather densely clothed with short, semierect, white hairs; epistoma rather narrow between the antennae, not elevated, but broadly, arcuately emarginate in front; antenna short, serrate from the fourth joint, the outer joints rather compact and about as long as wide; eyes large, equally rounded above and beneath.

Pronotum one fourth wider than long, subequal in width at base and apex, widest at middle; sides feebly, arcuately rounded from apical angles to posterior angles, which are rectangular; when viewed from the side the marginal carina feebly sinuate, and the submarginal carina only vaguely indicated; anterior margin slightly sinuate, with the median lobe feebly produced and broadly rounded; base feebly, broadly, arcuately emarginate on each side, with the median lobe moderately produced and broadly rounded; disk strongly convex, with a broad, rather deep, oblique depression on each side along lateral margin, broadly elevated on each side near posterior angle.

but without distinct oval swellings or prehumeral carinae; surface feebly, coarsely, irregular rugose, rather densely, coarsely punctate between the rugae, sparsely, uniformly clothed with short, semierect, white hairs. Scutellum without a transverse carina, the surface vaguely reticulate.

Elytra slightly wider than pronotum at base, subequal in width at base and behind middle; sides parallel for a short distance behind base, broadly, deeply, arcuately constricted in front of middle, broadly, arcuately expanded behind middle, then arcuately narrowed to the tips, which are separately narrowly rounded and finely serrulate; sides of abdomen not exposed above; disk slightly convex, without median costae, the sutural margins feebly elevated posteriorly, and with broad, moderately deep, basal depressions; surface densely, finely imbricate-punctate, sparsely, uniformly clothed with short, semierect, inconspicuous hairs.

Abdomen beneath densely marked with distinct, transverse, crenulate lines, imbricate toward the sides of basal segment, finely rather densely punctate, and rather densely, uniformly clothed with short, recumbent, whitish hairs; first segment convex at middle, the suture between first and second segments not indicated at the sides; last segment broadly rounded at apex; vertical portions of the segments not conspicuously pubescent; pygidium densely, coarsely punctate, strongly carinate, but the carina not projecting at apex. Prosteronum more or less rugose, coarsely, rather densely punctate, sparsely clothed with short, semierect, white hairs; prosternal lobe broad, strongly declivous, broadly, transversely subtruncate in front, prosternal process broad, the sides parallel to behind the coxal cavities, then obliquely narrowed to the apex, which is acute. Tibiae slender, the anterior and middle pairs slightly arcuate and armed with a very small tooth on inner margin at apices. Posterior tarsi slightly shorter than tibiae, the first joint as long as the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth broad, distinctly shorter than outer one, and not turned inward.

Length, 8.5 mm; width, 2.5 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 49567.

Remarks.—Described from a unique male collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species resembles *muticus* LeConte, but it differs from that species in having the antenna serrate from the fourth joint, the pronotum strongly elevated near the posterior angles, and the elytra without longitudinal costae.

AGRILUS TEJUPILCOENSIS, new species

Female.—Rather robust, strongly flattened above, feebly shining; above and beneath reddish cupreous, with a vague aeneous reflection, the elytra ornamented with yellowish-white pubescent spots.

Head with the front rather wide, nearly flat, slightly wider at top than at bottom, lateral margins feebly converging from top to bottom, and with a broad depression extending to the lateral margins; surface finely, densely granulate, vaguely rugose, sparsely, coarsely punctate, and sparsely clothed with short, inconspicuous hairs; epistoma slightly transverse between the antennae, subtriangular, strongly elevated, broadly, rather deeply, arcuately emarginate in front, the surface depressed; antenna short, serrate from the fourth joint, the outer joints strongly triangular and about as long as wide; eyes large, equally rounded above and beneath.

Pronotum one third wider than long, about equal in width at base and apex, widest at middle; sides feebly, arcuately rounded from apical angles to posterior angles, which are rectangular; when viewed from the side the marginal carina moderately sinuate, the submarginal carina nearly straight, the two carinae widely separated anteriorly but joined behind the middle; anterior margin nearly transversely truncate, without a median lobe; base rather deeply, angularly emarginate at middle of each elytron, with the median lobe strongly produced, broadly rounded, and subtruncate in front of scutellum; disk moderately convex, with a broad, rather deep, median depression extending from anterior margin to base, a broad depression on each side along lateral margin, but without prehumeral carinae or round swellings near the posterior angles; surface vaguely granulate, coarsely but not deeply, more or less transversely rugose, sparsely, finely punctate between the rugae, rather densely clothed in the median and lateral depressions with moderately long, recumbent, yellowish-white pubescence. Scutellum strongly, transversely carinate, the surface finely, densely reticulate.

Elytra slightly wider than pronotum at base, subequal in width at base and behind middle; sides nearly parallel to behind middle (vaguely constricted in front of middle), then obliquely narrowed to the tips, which are separately narrowly rounded and finely serrulate; sides of abdomen broadly exposed above; disk rather strongly flattened along sutural margins, which are slightly elevated posteriorly, with broad, deep, basal depressions, and a vague, obtuse, longitudinal costa at middle of each elytron; surface coarsely, densely, imbricate-punctate, each elytron ornamented with short, recumbent, yellowish-white pubescence as follows: A small spot in basal depression; a small, round spot near middle at basal third; a small, round spot at middle near lateral margin; an elongate spot at apical third

near sutural margin; behind this spot a narrow vitta extending along sutural margin to apex; and a minute spot on middle of elytron at apical fourth.

Abdomen beneath vaguely granulose, sparsely marked with transverse, crenulate lines, which are coarser on basal segment, sparsely, finely punctate, sparsely, uniformly clothed with short, recumbent, white hairs, and the third and fourth segments ornamented on each side with a spot of dense, yellowish-white pubescence; first segment strongly convex at middle, the suture between first and second segments not indicated at the sides; last segment broadly rounded at apex; vertical portions of the segments densely clothed with recumbent, yellowish-white pubescence, except the second, which is glabrous; pygidium densely granulose, sparsely, coarsely punctate, without a projecting carina at apex. Prosternum rather coarsely, sparsely punctate, sparsely clothed with moderately long, semierect, white hairs; prosternal lobe broad, slightly declivous, broadly, arcuately rounded in front; prosternal process broad, the sides parallel to behind the coxal cavities, then obliquely narrowed to the apex, which is acute and bent downward. Mesosternum, metasternum, and posterior coxae densely clothed at the sides with long, recumbent, yellowish-white pubescence. Tibiae slender, unarmed at apices, the anterior pair feebly arcuate. Posterior tarsi slightly shorter than tibiae; the first joint slightly longer than the following two joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth broad, distinctly shorter than outer one, and not turned inward.

Length, 8.5 mm; width, 2.1 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 49568.

Remarks.—Described from a unique female collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species is more or less closely allied to *albofasciatus* Waterhouse, but it differs from that species in having the head broadly depressed in front, the pronotum more broadly depressed at middle, the elytra uniformly dull reddish-cupreous, and each elytron ornamented with a narrow, yellowish-white, pubescent vitta along the sutural margin at apical fourth.

AGRILUS MONTEZUMA, new species

Male.—Elongate, slender, rather strongly flattened above, rather strongly shining; head aeneo-virideous, becoming reddish cupreous on occiput; pronotum reddish cupreous; elytra black, with a vague purplish tinge; beneath cupreous, with a more or less distinct aeneous or reddish reflection in certain lights.

Head with the front narrow, nearly flat, about equal in width at top and bottom, lateral margins parallel, vaguely, longitudinally depressed; surface coarsely, deeply, irregularly rugose, coarsely punctate between the rugae, sparsely clothed with short, recumbent, white hairs; epistoma narrow between the antennae, not elevated, but broadly, arcuately emarginate in front; antenna moderately long, serrate from the fifth joint, the outer joints triangular and about as long as wide; eyes large, oval, equally rounded above and beneath.

Pronotum slightly wider than long, subequal in width at base and apex, widest at middle; sides rather strongly, arcuately rounded from apical angles to posterior angles, which are rectangular; when viewed from the side the marginal carina nearly straight, the submarginal carina feebly sinuate, and the two carinae narrowly separated for their entire length; anterior margin strongly sinuate, the median lobe very strongly produced and broadly rounded; base broadly, angularly emarginate at middle of each elytron, with the median lobe strongly produced and broadly rounded; disk moderately convex anteriorly, feebly, transversely flattened on basal half, the flattened area extending obliquely forward on each side to the lateral margin at apical third, without prehumeral carinae or round swellings near posterior angles; surface coarsely, deeply, more or less transversely rugose, finely, sparsely punctate between the rugae, nearly glabrous. Scutellum feebly, transversely carinate the surface densely, finely reticulate.

Elytra slightly wider than pronotum at base, slightly narrower at base than behind middle; sides parallel for a short distance behind base, feebly, broadly, arcuately constricted in front of middle, arcuately expanded behind middle, then obliquely narrowed to near the tips, where they are vaguely expanded, the tips separately broadly rounded and rather coarsely serrulate; sides of abdomen not exposed above; disk feebly flattened along sutural margins, which are slightly elevated posteriorly, with broad, moderately deep, basal depressions, and a vague, obtuse, longitudinal costa at middle of each elytron; surface densely, coarsely imbricate-punctate, sparsely, uniformly clothed with short, semierect, inconspicuous, white hairs.

Abdomen beneath feebly granulose, densely marked with transverse, crenulate lines, which are coarser on basal segment, finely, rather densely punctate, and rather densely, uniformly clothed with short, recumbent, whitish hairs; first segment strongly convex at middle, the suture between the first and second segments not indicated at the sides; last segment broadly rounded at apex; vertical portions of the segments not conspicuously pubescent; pygidium coarsely, densely punctate, without a projecting carina at apex. Prosternum rather coarsely, sparsely punctate, sparsely clothed with long, erect, white hairs; prosternal lobe broad, strongly declivous,

broadly, transversely truncate in front; prosternal process broad, the sides parallel to behind the coxal cavities, then obliquely narrowed to the apex, which is acute. Tibiae slender, the anterior and middle pairs slightly arcuate and armed with a very small tooth on inner margin at apices. Posterior tarsi about one half as long as the tibiae, the first joint as long as the following three joints united. Tarsal claws similar on all feet, cleft near the middle, the inner tooth broad, shorter than outer one, and not turned inward.

Length, 7.25 mm; width, 1.6 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 49569.

Remarks.—Described from a single male collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species resembles *ruficollis* Fabricius, but it differs from that species in being slenderer, in having the head nearly convex in front, the antennae serrate from the fifth joint, the pronotum with the surface coarsely, transversely rugose, and the anterior margin strongly produced at middle, and in each elytron having an obtuse, longitudinal, median costa.

TAPHROCERUS SHANNONI, new species

Elongate, more strongly attenuate posteriorly, feebly flattened above, glabrous; above and beneath uniformly black, with a vague aeneous reflection in certain lights.

Head slightly narrower than pronotum at base, strongly convex from top to bottom, nearly flat transversely, the front slightly wider at top than at bottom, lateral margins feebly converging from top to bottom, with a shallow, triangular depression behind the epistoma, and a vague, narrow, longitudinal groove extending from the depression to the occiput; surface finely, densely reticulate, sparsely, finely, irregularly punctate, clothed with a few short, inconspicuous hairs.

Pronotum moderately convex, twice as wide as long, subequal in width at base and apex, widest at basal third; sides when viewed from above obliquely expanded from apical angles to basal third, then obliquely narrowed to the posterior angles, which are obtusely angulated; anterior margin transversely truncate; base transversely truncate to middle of each elytron, with the median lobe moderately produced and arcuately emarginate in front of scutellum; disk feebly, narrowly, transversely depressed along anterior margin, broadly depressed along lateral margins, the depression extending obliquely backward on each side to the base, with a rounded elevation near the posterior angles; surface densely, finely reticulate,

sparsely, irregularly ocellate-punctate. Scutellum small, triangular, arcuately rounded in front, the surface feebly reticulate.

Elytra moderately convex above, slightly wider than pronotum at base, subequal in width at base and near middle; humeral angles obtuse; sides obliquely expanded from base to basal sixth, arcuately constricted at basal third, arcuately rounded at middle, then obliquely narrowed to the tips, which are separately rather broadly rounded, and irregularly serrulate; humeri moderately developed; disk with broad, transverse basal depressions, each elytron with a distinct, short, straight carina extending from humerus to basal third; surface feebly, coarsely, irregularly punctate, the punctures very shallow, and becoming obsolete toward apices.

Abdomen beneath feebly, rather coarsely reticulate, very sparsely, feebly, irregularly ocellate-punctate, the punctures very shallow, elongate, open posteriorly, with a short, inconspicuous hair at the middle of each puncture; last segment broadly rounded at apex, with the apical groove deep, and following the outline of the apical half of the segment. Prosternum densely, finely reticulate.

Length, 3 mm; width, 1 mm.

Type locality.—Sabanas, Panama.

Type and paratypes.—U.S.N.M. No. 49570.

Remarks.—Described from eight examples (one type). The type and two paratypes were collected at the type locality, April 20, 1923, by R. C. Shannon; one paratype was collected on Taboga Island, Panama, February 26, 1912, by A. Busck; one paratype at Porto Bello, Panama, February 15, 1911, by E. A. Schwarz; one paratype at Limon, Canal Zone, June 10, 1919, by H. F. Dietz and J. Zetek; one paratype on Flat Rock Plantation, Chagres River, Panama, August 24, 1918, by H. F. Dietz and J. Zetek; and one paratype on Taboga Island, Panama, September 21–22, 1918, by the same collectors. Sexes not determined.

In Dr. J. Obenberger's revision of the genus *Taphrocerus*,¹ this species runs down to *rusticus* Thomson in his table of species, but it differs from that species in being glabrous and in having the elytra broadly rounded at the apices.

TAPHROCERUS DIETZI, new species

Elongate, slightly more attenuate posteriorly, feebly flattened above, and nearly glabrous; above and beneath aeneous, with a feeble cupreous tinge.

Head slightly narrower than pronotum at base, strongly convex from top to bottom, nearly flat transversely, the front slightly wider at top than at bottom, lateral margins feebly converging from top

¹ Sbornik, vol. 2, p. 52, 1924.

to bottom, broadly, transversely flattened behind the epistoma, with a shallow, narrowly triangular depression on the front, and a vague, narrow, longitudinal groove extending from depression to occiput; surface densely, finely reticulate, transversely rugose behind the epistoma, sparsely, finely, irregularly punctate, and sparsely clothed with recumbent, white hairs, which are longer and denser on the flattened area behind the epistoma.

Pronotum moderately convex, twice as wide as long, slightly narrower at apex than at base, and widest at basal third; sides when viewed from above obliquely expanded from apical angles to basal third, then strongly arcuately narrowed to the posterior angles which are rectangular; anterior margin transversely truncate; base transversely truncate to middle of each elytron, with the median lobe moderately produced, and feebly, arcuately emarginate in front of scutellum; disk rather deeply, narrowly, transversely depressed along anterior margin, broadly, deeply depressed anteriorly along lateral margins, broadly, deeply depressed on basal half, the depression more shallow in front of scutellum; surface densely, finely reticulate, with a few scattered ocellate-punctures in the depressions, and clothed with a few short, inconspicuous hairs. Scutellum small, triangular, arcuately rounded in front, the surface obsoletely reticulate.

Elytra moderately convex, slightly wider than pronotum at base, subequal in width at base and behind middle; humeral angles obtuse; sides arcuately expanded behind base, strongly, arcuately constricted at basal fourth, arcuately rounded at middle, then obliquely narrowed to the tips, which are conjointly broadly rounded, and coarsely, irregularly serrulate; humeri smooth, rather strongly developed; disk with broad, deep, transverse, basal depressions, but without longitudinal carinae; surface coarsely, irregularly punctate, the punctures forming more or less distinct rows on basal halves, but becoming obsolete toward apices.

Abdomen beneath feebly, rather coarsely reticulate, sparsely, irregularly ocellate-punctate, the punctures very shallow, elongate, open posteriorly, and each provided with a very short white hair arising from its center; last segment broadly rounded at apex, with the apical groove deep and following the outline of the apical half of the segment. Prosternum finely, densely reticulate.

Length, 3.25 mm; width, 1.13 mm.

Type locality.—Coban, Alta Vera Paz, Guatemala.

Type.—U.S.N.M. No. 49571.

Remarks.—Described from a single example (sex not determined) collected at the type locality in May 1926 by Dr. J. M. Aldrich. The type has a distinct bluish or purplish color on the elytra, but this is probably due to discoloration.

This species is allied to *fnitimus* Obenberger, but it differs from that species in having the head distinctly depressed in front, the pronotum widest at the basal third, with the sides strongly, arcuately narrowed near the posterior angles, where the surface is deeply depressed.

BRACHYS HINTONI, new species

Male.—Broadly cuneiform, twice as long as wide, broadly rounded in front, more acuminate posteriorly, moderately shining, and sparsely pubescent, the pubescence pale yellow and forming more or less distinct designs on the elytra; above dark brown, with a more or less distinct aeneous and cupreous reflection in certain lights; beneath piceous, with a distinct aeneous tinge.

Head strongly flattened and vaguely depressed in front, without gibbositics on the vertex, but with a narrow, longitudinal groove on the front, the groove becoming obsolete on the occiput and behind the epistoma; surface vaguely granulose, finely, sparsely, irregularly punctate, and sparsely, irregularly clothed with long, recumbent, golden-yellow hairs; epistoma transverse between the antennal cavities, feebly elevated, but not transversely carinate in front;

Pronotum moderately convex, nearly two and one half times as wide as long at middle, distinctly narrower at apex than at base, and widest at base; sides obliquely narrowed from base to apical angles; when viewed from the side the lateral margin nearly straight anteriorly, arcuately sinuate near the posterior angle for the reception of the anterior leg; anterior margin transversely truncate; base transversely truncate to middle of each elytron, where it is feebly, arcuately emarginate, then turning obliquely backward to the scutellum, in front of which it is feebly, arcuately emarginate; posterior angles narrowly rounded; disk feebly, narrowly, transversely depressed behind anterior margin, broadly, transversely concave on basal half, the concavity extending obliquely forward to the apical angles, causing the antero-median part of the disk to be regularly convex, but without a distinct carina near posterior angles; surface densely, obsoletely reticulate, coarsely, densely ocellate-punctate in the depressions, sparsely, irregularly clothed with long, recumbent, yellowish hairs. Scutellum triangular, feebly wider than long, the anterior margin feebly rounded, the surface vaguely reticulate.

Elytra as wide as pronotum at base; humeral angles subrectangular; sides nearly parallel to middle (feebly, arcuately constricted at basal fourth), then obliquely narrowed to the tips, which are separately narrowly rounded, with the lateral margins entire; disk with distinct lateral carinae, which are sinuate, strongly elevated, and extend from humeral angles to near the apices, a broad depression on each side behind the humeral angle, and with broad, moderately

deep, basal depressions; surface finely, densely, irregularly punctate, with numerous irregular, smooth areas, and each elytron ornamented with long, recumbent, yellowish-white pubescence as follows: A few scattered hairs on basal third; a broad, more or less distinct, irregular, transverse fascia at middle; and a similar fascia covering the apical fourth.

Abdomen beneath densely, obsoletely reticulate, sparsely, feebly, ocellate-punctate, the punctures oblong, open posteriorly, a short, recumbent, white hair arising from each puncture; last segment broadly, obtusely rounded at apex, with the margin entire, and the apical groove deep, transversely truncate posteriorly, and following the outline of the lateral margin on each side.

Length, 3.5 mm; width, 1.7 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 49572.

Remarks.—Described from a unique male collected at the type locality at an altitude of 3,900 feet, during July 1932, by H. E. Hinton.

This species resembles *nevermanni* Fisher, but it differs from that species in having the epistoma transverse between the antennal cavities, the pronotum subequal in width to the elytra and without distinct prehumeral carinae, and the pubescence on the elytra uniformly yellowish white.

BRACHYS LINEIFRONS, new species

Female.—Broadly cuneiform, twice as long as wide, broadly rounded in front, slightly narrower behind than in front, moderately shining, the elytra ornamented with silvery white pubescent spots; above dark brown, with more or less distinct purplish, aeneous, and greenish reflections in certain lights; beneath piceous, with a feeble aeneous reflection.

Head feebly convex, broadly, longitudinally depressed, without gibbosities on the vertex, but with a narrow, longitudinal groove extending from occiput to near the epistoma; surface feebly, finely reticulate, sparsely punctate, and very sparsely, irregularly clothed with long, semierect, whitish and yellowish hairs; epistoma rather narrow between the antennal cavities, the sides feebly elevated, but not transversely carinate in front.

Pronotum moderately convex, slightly more than twice as wide as long at middle, distinctly narrower at apex than at base, widest at base; sides obliquely narrowed from base to apical angles; when viewed from the side the lateral margin slightly sinuate anteriorly, and more strongly arcuate near the posterior angle for the reception of the anterior leg; anterior margin transversely truncate;

base transversely truncate to middle of each elytron, where it is feebly, arcuately emarginate, then turning obliquely backward to the scutellum, in front of which it is feebly, arcuately emarginate; posterior angles nearly rectangular; disk broadly, transversely concave on basal half, the concavity extending obliquely forward on each side to the apical angle, causing the antero-median part of the disk to be regularly convex, and with a distinct, short carina on each side near the posterior angle; surface densely, finely reticulate, finely, sparsely punctate on convex area, coarsely ocellate-punctate in the depressions, and sparsely, irregularly clothed with rather long, semierect, white and yellow hairs intermixed, the white hairs predominating at the sides. Scutellum triangular, slightly wider than long, with the anterior margin feebly rounded and the surface densely, obsoletely reticulate.

Elytra slightly narrower than pronotum at base; humeral angles rectangular; sides nearly parallel or feebly sinuate to middle, then obliquely narrowed to the tips, which are separately narrowly rounded, with the lateral margins entire; disk with distinct lateral carinae, which are sinuate, strongly elevated, and extending from humeral angles to near the apices, and with broad, moderately deep, basal depressions; surface more or less alutaceous, sparsely, finely, irregularly punctate on basal halves, but the punctures becoming obsolete posteriorly, and each elytron ornamented with pubescent designs as follows: A single longitudinal row of brownish-yellow hairs extending from basal lobe to near middle; numerous irregularly distributed, semierect, brownish-yellow hairs on basal half; a broad, irregular fascia of inconspicuous, black hairs behind middle; a sparse uniform clothing of short, semierect, brownish-yellow hairs on apical fourth; a broad fascia of irregularly distributed, widely separated, white pubescent spots at middle; a similar fascia at apical fourth; and an inconspicuous, white, pubescent spot at apex.

Abdomen beneath densely, obsoletely reticulate, sparsely ocellate-punctate, the punctures large, oblong, and open posteriorly, and sparsely clothed with short, recumbent, white hairs toward the sides and on last segment, which is broadly rounded at apex, with the margin finely crenulate, and the apical groove deep, transversely truncate posteriorly, and following the outline of the lateral margin on each side.

Length, 2.6 mm; width, 1.25 mm.

Type locality.—La Ceiba, Honduras.

Type.—U.S.N.M. No. 49573.

Remarks.—Described from a unique female collected at the type locality, August 22, 1916, by F. J. Dyer.

This species resembles *ornatus* Fisher, but it differs from that species in being more acuminate posteriorly and in having the white pubescent spots on the elytra more distinct.

BRACHYS ZETEKI, new species

Male.—Broadly cuneiform, twice as long as wide, broadly rounded in front, slightly narrower behind than in front, strongly shining, the elytra ornamented with distinct, transverse, whitish pubescent fasciae; head aureo-aeneous in front; pronotum and elytra dark green, with a more or less distinct bluish or purplish reflection in certain lights; beneath black, strongly shining.

Head slightly convex, transversely flattened behind the epistoma, with two broad, feeble gibbosities and a narrow, longitudinal groove on the front, the groove becoming obsolete on the occiput and behind the epistoma; surface finely, densely reticulate, sparsely, finely, irregularly punctate on vertex and occiput, more densely punctate behind the epistoma, sparsely, irregularly clothed with short, semierect, yellowish hairs on occiput and vertex, densely clothed with moderately long, erect, yellow hairs behind the epistoma, and with a round glabrous area on each side of the front; epistoma feebly transverse between the antennal cavities, strongly elevated, but not transversely carinate.

Pronotum moderately convex, two and one half times as wide as long at middle, distinctly narrower at apex than at base, and widest at base; sides arcuately narrowed from base to apical angles; when viewed from the side the lateral margin nearly straight anteriorly, strongly arcuate near the posterior angle for the reception of the anterior leg; anterior margin transversely truncate; base transversely truncate to middle of each elytron, where it is feebly, arcuately emarginate, then turning obliquely backward to the scutellum, in front of which it is feebly, arcuately emarginate; posterior angles obtusely rounded; disk broadly, transversely concave on basal half, the concavity extending obliquely forward on each side to the apical angle, causing the antero-median part of the disk to be regularly convex, and with a feeble, obtusely rounded, arcuate carina on each side near the posterior angle; surface densely, finely reticulate, sparsely, finely punctate on convex area, coarsely ocellate-punctate in depressions, and sparsely, irregularly clothed with moderately long, semierect, white hairs. Scutellum triangular, slightly wider than long, with the anterior margin feebly rounded, and the surface densely, obsolete reticulate.

Elytra slightly narrower than pronotum at base; humeral angles obtusely rounded; sides strongly sinuate to middle, then obliquely narrowed to the tips, which are separately narrowly rounded, with

the lateral margins entire; disk with distinct lateral carinae, which are sinuate, strongly elevated, and extending from humeral angles to near the apices, a broad depression on each side behind the humeral angle, and with broad, moderately deep, basal depressions; surface feebly rugose, sparsely, finely, irregularly punctate, rather densely, irregularly clothed with moderately long, semierect, white hairs, and with a broad, transversely oblique fascia of inconspicuous, black hairs just behind the middle.

Abdomen beneath densely, obsoletely reticulate, sparsely, feebly ocellate-punctate, the punctures large, oblong, and open posteriorly, sparsely clothed with short, recumbent, white hairs toward the sides and on last segment, which is broadly rounded at apex, with the margin entire, and the apical groove deep, transversely truncate posteriorly, and following the outline of the lateral margin on each side.

Length, 2.75 mm; width, 1.3 mm.

Type locality.—Taboga Island, Panama.

Type and paratype.—U.S.N.M. No. 49574.

Remarks.—Described from two males (one type) collected at the type locality, June 19, 1919, by H. F. Dietz and J. Zetek.

This species is allied to *lactus* Waterhouse, but it differs from that species in having the epistoma transverse between the antennal cavities, and in having the elytra rather densely, irregularly clothed with white hairs, with a broad, transversely oblique, black pubescent fascia just behind the middle.

PACHYSHELUS VALERIO, new species

Female.—Broadly cuneiform, one and one half times as long as wide, more strongly narrowed behind than in front, strongly shining, glabrous; head, pronotum, scutellum, and beneath piceous, with a feeble aeneous reflection; elytra blue, with a vague violaceous tinge.

Head strongly convex, without a distinct longitudinal groove on the front; surface finely, densely granulose, with a few coarse, irregularly distributed punctures intermixed, and nearly glabrous.

Pronotum slightly convex, four times as wide as long at middle, much narrower at apex than at base, and widest at base; sides strongly, arcuately narrowed from base to apical angles, which are acute; posterior angles acute, projecting slightly beyond the humeral angles of the elytra and fitting closely to them; anterior margin deeply, arcuately emarginate; base transversely sinuate, broadly, vaguely, arcuately emarginate in front of scutellum; surface even, feebly depressed toward the sides, smooth, sparsely, feebly, irregularly ocellate-punctate. Scutellum large, broadly triangular, the surface smooth.

Elytra as wide as pronotum at base, widest at basal fourth; humeral angles broadly rounded; sides nearly parallel or vaguely rounded from base to near middle, then strongly, arcuately narrowed to the tips, which are conjointly broadly rounded, the lateral margin vaguely serrate, and when viewed from the side nearly straight from base to apex, except for a broad, arcuate sinuation for the reception of the posterior leg; each elytron with a broad, deep depression along the lateral margin behind the humerus, and with a broad, vague, basal depression; surface more or less rugose, coarsely, rather densely, irregularly punctate, the punctures becoming obsolete toward the apices.

Abdomen beneath feebly convex, vaguely granulose; last segment transversely concave, the apical margin deeply, broadly, arcuately emarginate at the middle, with three or four short teeth arranged in a semicircle on each side of the emargination. Metasternum very broadly emarginate in front. Prosternum feebly, broadly, arcuately emarginate in front; prosternal process very broad, broadly rounded at apex. Prothoracic epipleura broad and nearly flat. Antennal groove deep, parallel with the lateral margin.

Length, 2.75 mm; width, 1.5 mm.

Type locality.—San Jose, Costa Rica.

Type.—U.S.N.M. No. 49575.

Remarks.—Described from a unique female collected at the type locality at an altitude of 1,160 meters by M. Valerio.

This species is closely allied to *infidelis* Obenberger, but it differs from that species in being glabrous, in having the elytra blue and distinctly punctured, and in the different arrangement of the teeth on the apical margin of the last abdominal segment.

LIUS HINTONI, new species

Male.—Elongate, broadly cuneiform, moderately convex, strongly shining; head and pronotum cupreous, the former slightly aeneous in front; elytra purplish, with a slight bluish-black reflection in certain lights; beneath brown, with a distinct aeneous tinge.

Head with the front as wide as the transverse diameter of the eye, slightly wider at top than at bottom, lateral margins feebly converging from top to bottom, deeply, longitudinally depressed, the depression extending to the lateral margins, but becoming obsolete on the occiput, and with a narrow, longitudinal groove extending from epistoma to vertex; surface glabrous, densely, finely reticulate, sparsely, rather coarsely, irregularly punctate; eyes moderately convex; frontal pores large, median, and contiguous; epistoma very narrow between the antennal cavities, strongly, angularly elevated, the antennae nearly contiguous.

Pronotum moderately convex, two and one half times as wide as long at base; distinctly narrower at apex than at base, and widest at base; when viewed from above the sides arcuately expanded at base, then arcuately narrowed to the apical angles; posterior angles rather acutely rounded and feebly projecting; anterior margin feebly, broadly, arcuately emarginate; base feebly, transversely sinuate to middle of each elytron, then turning obliquely backward to the scutellum, in front of which it is vaguely, arcuately emarginate; surface feebly, broadly flattened toward the sides, glabrous, densely, finely reticulate at the sides, smoother on median part, and sparsely, coarsely, irregularly punctate. Scutellum large, triangular, anterior margin vaguely rounded, the surface nearly smooth.

Elytra moderately convex, uneven, as wide as pronotum at base; humeral angles obtusely angulated; sides nearly parallel to basal third, then strongly, arcuately narrowed to the tips, which are conjointly broadly rounded, with the lateral margins vaguely serrate; humeri prominent; surface glabrous, sparsely, finely, irregularly punctate on apical halves, with numerous small, irregularly arranged, depressed areas on basal halves, the depressions finely reticulate, each elytron with a large, rounded elevation behind the scutellum, a similar one along the lateral margin at middle, and an elongate elevation at apex.

Abdomen beneath finely, densely reticulate, sparsely, rather coarsely, irregularly punctate, and sparsely clothed with short, recumbent, white hairs; last segment broadly rounded at apex, with the apical groove deep and following the outline of the lateral margins. Prosternum finely, densely reticulate, the anterior margin subtruncate or vaguely rounded; prosternal process narrow, sparsely punctate, the sides feebly, broadly constricted at the coxal cavities, broadly rounded at apex.

Length, 2.75 mm; width, 1.35 mm.

Type locality.—Real de Arriba, Mexico, D.F.

Type.—U.S.N.M. No. 49576.

Paratype.—In the H. E. Hinton collection.

Remarks.—Described from two males (one type) collected at the type locality at an altitude of 6,300 feet, during July 1932, by H. E. Hinton.

This species resembles *splendens* Fisher, but it differs from that species in having the front of the head more deeply depressed and the elytra very uneven.

LIUS SPLENDENS, new species

Male.—Elongate, broadly cuneiform, moderately convex, strongly shining; head and pronotum cupreous, the former feebly aeneous

in front; elytra purplish; beneath dark brown, with a distinct aeneous tinge.

Head with the front slightly narrower than the transverse diameter of the eye, slightly wider at top than at bottom, the lateral margins feebly converging from top to bottom, moderately, longitudinally depressed, the depression extending to the lateral margins, but becoming obsolete on the occiput, and with a narrow, longitudinal groove extending from epistoma to vertex; surface glabrous, feebly, densely reticulate, very sparsely, coarsely, irregularly punctate; eyes moderately convex; frontal pores large, narrowly separated; epistoma very narrow between the antennal cavities, strongly elevated, the antennae nearly contiguous.

Pronotum moderately convex, two and one half times as wide as long at base, distinctly narrower at apex than at base, widest at base; when viewed from above, the sides obliquely narrowed from base to apical angles; posterior angles rectangular, not projecting; anterior margin broadly, arcuately emarginate; base feebly, transversely sinuate to middle of each elytron, then turning obliquely backward to the scutellum, in front of which it is vaguely, arcuately emarginate; surface uniformly convex, glabrous, vaguely reticulate, sparsely, coarsely, irregularly punctate. Scutellum large, triangular, the anterior margin vaguely rounded, the surface smooth.

Elytra moderately convex, as wide as pronotum at base; humeral angles obtuse; sides arcuately narrowed from the humeral angles to the tips, which are conjointly broadly rounded, the lateral margins vaguely serrate; humeri rather prominent; surface glabrous, slightly rugose at the sides, rather densely, coarsely, irregularly punctate, the punctures coarser, more or less arranged in longitudinal rows on the basal halves toward sutural margins.

Abdomen beneath finely, densely reticulate, sparsely, finely, irregularly punctate, very sparsely clothed with short, recumbent, white hairs; last segment broadly rounded at apex, with the apical groove deep and following the outline of the lateral margins. Prosternum feebly reticulate, the anterior margin subtruncate or vaguely rounded; prosternal process moderately wide, sparsely, coarsely punctate, clothed with a few white hairs, the sides nearly parallel (vaguely constructed at coxal cavities), broadly rounded at apex.

Length, 2.5 mm; width, 1.25 mm.

Type locality.—Tegucigalpa, Honduras.

Type and paratype.—U.S.N.M. No. 49577.

Remarks.—Described from two males (one type) collected at the type locality, June 25, 1918, by F. J. Dyer.

This species is allied to *variabilis* Waterhouse, but it differs from that species in coloration and in having the front of the head nar-

rower, the epistoma very narrow between the antennal cavities, and the antennae nearly contiguous at their bases.

LIUS CALLIMICRIFORMIS, new species

Male.—Oblong, moderately convex, broadly rounded in front, more strongly attenuate posteriorly, strongly shining; head and pronotum cupreous, with a slight reddish tinge; scutellum and elytra dark greenish-blue, with a vague violaceous reflection; beneath black, with the prosternal process slightly cupreous.

Head with the front slightly wider than the transverse diameter of the eye, slightly wider at top than at bottom, lateral margins feebly converging from top to bottom, deeply, longitudinally depressed, the depression extending to the lateral margins, but becoming obsolete on the occiput, and without a distinct longitudinal groove: surface glabrous, densely, finely reticulate, sparsely, rather coarsely, irregularly punctate; eyes moderately convex; frontal pores large, narrowly separated; epistoma very narrow between the antennal cavities, strongly elevated, and the antennae nearly contiguous.

Pronotum moderately convex, twice as wide as long at base, distinctly narrower at apex than at base, widest at base; when viewed from above the sides nearly parallel or feebly sinuate posteriorly, obliquely narrowed anteriorly; posterior angles obtusely rounded, not projecting; anterior margin feebly, broadly, arcuately emarginate; base feebly, transversely sinuate to middle of each elytron, then turning obliquely backward to the scutellum, in front of which it is feebly, arcuately emarginate; surface uniformly convex, without distinct depressions, glabrous, finely, densely reticulate, very sparsely, rather coarsely, irregularly punctate. Scutellum large, triangular, anterior margin arcuately rounded, the surface smooth.

Elytra moderately convex, slightly narrower than pronotum at base, subequal in width at base and behind middle; humeral angles obtusely rounded; sides nearly parallel from base to behind middle (feebly, broadly constricted in front of middle), then arcuately narrowed to the tips, which are separately narrowly rounded, with the lateral margins entire; humeri not very prominent; surface glabrous, more or less rugose, densely, coarsely, irregularly punctate, the punctures becoming finer toward the apices.

Abdomen beneath finely, densely reticulate, feebly, sparsely punctate, sparsely clothed with short, inconspicuous hairs; last segment broadly rounded at apex, with the apical groove deep, following the outline of the lateral margins, but interrupted on each side of the middle at apex. Prosternum finely, densely reticulate, the anterior margin subtruncate and feebly elevated; prosternal process narrow, sparsely, coarsely punctate, the sides feebly, broadly constricted at the coxal cavities, broadly rounded at apex.

Length, 3.35 mm; width, 1.35 mm.

Type locality.—Real de Arriba, Mexico, D.F.

Type.—U.S.N.M. No. 49578.

Remarks.—Described from a unique male collected at the type locality at an altitude of 6,300 feet, July 16, 1932, by H. E. Hinton.

This species resembles *Callimicra lucida* Waterhouse, but it belongs to the genus *Lius* and differs from *lucida* in having the pronotum reddish cupreous, uniformly convex, and without lateral carinae, the head deeply depressed in front, the prosternal process narrow, with the sides constricted at the middle, and the metasternum very deeply and narrowly emarginate in front.

CALLIMICRA CYANESCENS, new species

Female.—Rather narrowly oblong, moderately convex, broadly, equally rounded in front and behind, rather strongly shining; above uniformly dark greenish blue, with a feeble violaceous tinge on the elytra; beneath piceous, with a vague aeneous reflection in certain lights.

Head with the front broad, moderately convex, subequal in width at top and bottom, lateral margins parallel, feebly longitudinally depressed behind the epistoma, and with a narrow, longitudinal carina extending from the occiput to a round, deep, median depression on the front; frontal pores very large, situated at the lateral margins and connected internally by a deep, transverse groove, which is interrupted at the middle; surface glabrous, finely, densely reticulate, sparsely, coarsely, irregularly punctate; epistoma very narrow between the antennal cavities, strongly elevated, the antennae nearly contiguous.

Pronotum moderately convex, one and one half times as wide as long, slightly narrower at apex than at base, and widest at basal third; sides feebly arcuate from base to middle, then strongly, arcuately narrowed to the apical angles; posterior angles obtuse; anterior margin rather strongly sinuate, with a broadly rounded, obsolete, median lobe; base transversely truncate to middle of each elytron, then turning obliquely backward to the scutellum, in front of which it is broadly subtruncate; surface broadly, deeply, transversely depressed along base, narrowly depressed along lateral margins, with obsolete lateral carinae extending from base to middle of pronotum, glabrous, finely, sparsely, irregularly punctate. Scutellum broadly triangular, anterior margin truncate, the surface nearly smooth.

Elytra moderately convex, about as wide as pronotum at base; humeral angles obtuse; sides nearly parallel from base to apical third (feebly, arcuately constricted at middle), then arcuately narrowed to the tips, which are separately rather broadly rounded, with the

lateral margins feebly serrate; humeri rather strongly developed; surface more or less rugose on basal halves, rather densely, coarsely, irregularly punctate, each elytron with a broad, deep depression along the lateral margin behind the humerus, and with a broad, deep, basal depression.

Abdomen beneath finely, densely reticulate, sparsely, finely punctate, nearly glabrous; last segment broadly rounded, feebly sinuate, narrowly truncate at apex. Prosternum glabrous, feebly reticulate, vaguely punctate, the anterior margin elevated at middle; prosternal process long, wide, sparsely, coarsely punctate, the sides arcuately narrowed to the apex, which is broadly rounded. Metasternum deeply, angularly emarginate in front.

Length, 3.75 mm; width, 1.4 mm.

Type locality.—Tejupilco, Mexico, D.F.

Type.—U.S.N.M. No. 45579.

Remarks.—Described from a unique female collected at the type locality at an altitude of 3,960 feet, during July 1932, by H. E. Hinton.

This species resembles *obtusa* Waterhouse, but it differs from that species in being slenderer and in having the pronotum more deeply depressed along the base and the elytra more coarsely punctured and more or less rugose.



REVISION OF THE BEETLES OF THE GENUS *DISONYCHA* OCCURRING IN AMERICA NORTH OF MEXICO

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HISTORY OF THE GENUS

The generic name *Disonycha* Chevrolat first appeared in the Dejean Catalogue of 1837¹ with 31 species listed under it. In 1844 Chevrolat² defined the genus as follows:

Disonycha (δύς δύο, ὄνυξ ongle). Genre de Coléoptères tétrameres, famille des Cycliques, tribu des Alticités, créé par nous, et adopté par M. Dejean, qui, dans son Catalogue, en énumère 30 [sic] espèces, dont 26 appartiennent à l'Amérique, 3 à l'Afrique australe et une à l'Asie. Nous citerons, parmi les premières, les *D. glabrata*, *conjugata*, *caroliniana* et *collaris* (*altica*) de Fabricius, *5-lineata*, *6-lineata* d'Olivier, et *4-rivittata* d'Illiger. Les insectes qui composent ce g. sont de moyenne grandeur; presque tous ont les élytres noires avec des lignes longitudinales jaunes; leurs tibias sont terminés extérieurement par deux ongles excessivement petits.

Of the original 31 species listed in the Dejean Catalogue, at least 6 of the North and South American species had been previously described, possibly more. Of these, only four are now considered as belonging to the genus *Disonycha*. *Galleruca collaris* Fabricius³ is not recognizable, and *Haltica quadrivittata* Illiger⁴ was listed by Illiger under the group Oedipodes. The remainder are: *Crioceris caroliniana* Fabricius,⁵ *C. glabrata* Fabricius,⁶ *C. collata* Fabricius,⁷ and *Haltica conjuncta* Germar.⁸ Since no previous designation seems to have been made, *Crioceris collata*, the most definitely described of the North American species included by Chevrolat (in Dejean), is hereby designated as the type of the genus.

¹ Catalogue des coléoptères de la collection de M. le Comte Dejean, p. 414, 1837.

² D'Orbigny, Dictionnaire universel d'histoire naturelle, vol. 5, p. 81, 1844.

³ Fabricius, Entomologia systematica, suppl., p. 97, 1798.

⁴ Illiger, Mag. für Insekt., vol. 6, p. 106, 1807.

⁵ Fabricius, Systema entomologiae, p. 122, 1775.

⁶ Fabricius, Species insectorum, vol. 1, p. 156, 1781.

⁷ Fabricius, Systema Eleutheratorum, vol. 1, p. 463, 1801.

⁸ Germar, Insectorum species, p. 610, 1824.

The earlier species of *Disonycha*—*caroliniana*, *glabrata*, *conjugata*, *collata*, and *discoidea*—were described by Fabricius in the genera *Crioceris*, *Chrysomela*, and *Galleruca*. Later he referred them all to *Galleruca*, with the exception of *Crioceris collata*, the only one having blue, unicolorous elytra, and *Chrysomela discoidea*, not a vittate form. Olivier (1789)⁹ placed *caroliniana* and *glabrata*, and later¹⁰ *conjugata* and *collata*, in *Altica*, a name emended by Illiger (1807) to *Haltica*, and this name in one spelling or the other was used for species of *Disonycha*, as well as other flea beetles, till long after the publication of the Dejean Catalogue, not only in European works but in descriptions by the early American coleopterists Harris, Say, and LeConte. Melsheimer¹¹ (1847) was the first in America to describe a species under the name *Disonycha*, and he used the same generic name in his catalogue of 1853 with 19 specific names listed. In Europe the name *Disonycha* appeared in the Sturm Catalogue (1843) and in a description by Mannerheim.¹² Clark (1865)¹³ redefined the genus, and Crotch (1873)¹⁴ constructed the first table of United States species, which contained 11 species and 1 variety. Since then, von Harold, Baly, Jacoby, and Weise have described many new species from South and Central America, and Jacoby, Casey, Horn, Blatchley, and Schaeffer have added 22 new specific names for North American forms. Horn's treatment (1889)¹⁵ of the Halticinae is the only work in which the genus as a whole, as it occurs north of Mexico, has been studied. Horn recognized 18 species, a number raised to 32 in the present revision.

The present paper is not written for the purpose of describing new species. In fact, only 2 new species and 3 new varieties are described. It is rather an attempt to create order in a genus in which, on the one hand, too many specific names have been based on differences in coloration unaccompanied by structural characters and, on the other, too many distinct species have been referred to synonymy. Furthermore, an attempt has been made to show the relationship of the species among themselves and the variations in a given species over its entire range.

DESCRIPTION OF THE GENUS

Disonycha, as a genus, has long been loosely defined because of its few outstanding characters. In order to include such diverse groups as at present make up the genus, the definition must necessarily be

⁹ Olivier Encyclopédie méthodique, vol. 4 (Insects, vol. 1), p. 105, 1789.

¹⁰ Olivier, Entomologie, vol. 6, pp. 686, 702, 1808.

¹¹ Melsheimer, Proc. Acad. Nat. Sci. Philadelphia, vol. 3, p. 163, 1847.

¹² Mannerheim, Bull. Soc. Imp. Moscou, vol. 16, p. 311, 1843.

¹³ Clark, Journ. Ent., vol. 2, no. 13, p. 401, 1865.

¹⁴ Crotch, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873.

¹⁵ Horn, Trans. Amer. Ent. Soc., vol. 16, p. 200, 1889.

wide. The species comprising the genus are for the most part among the larger species of Halticinae. They are distinguished from *Oedionychis*, *Homophoeta*, and other *Oedipodes* by the lack of the inflated hind claw joint. They are generally smaller than the species assigned to *Cacoscelis*, a genus from Central and South America, but, in some instances, difficult to distinguish, and they are so closely related to *Altica* that in some cases they can be distinguished only by the lack of a well-marked basal impression on the prothorax, a feature that is not always very evident in certain species of *Altica*.

The chief diagnostic characters are (1) in the head, in which there is a long extension of the carina or interantennal prominence from between the antennal bases to the suture above the labrum; (2) in the prothorax, which lacks a well-marked transverse basal impression, and the hind angles of which are obliquely truncate; (3) in the open precoxal cavities; and (4) in the hind legs, in which the posterior tibiae are not deeply grooved, the tibiae have a short apical spur, the first tarsal joint is about twice the length of the following one, and the claw joint is slender and appendiculate.

Horn stated that "*Disonycha* is far more homogeneous than *Oedionychis*, the species not exhibiting any marked structural differences among themselves, consequently any attempt at tabulation is more or less based on coloration, which seems to be quite constant as to type but variable in degree." On the contrary, the groups now included in *Disonycha* are not homogeneous but differ far more among themselves than do the groups inside such a genus as, for example, *Trirhabda*. Unfortunately, the material now available is not sufficient to justify an attempt at present to revise the whole genus and possibly to divide it into generic or subgeneric groups. *Disonycha* ranges from Canada to Patagonia. The forms found north of Mexico represent less than half of the described species, and presumably many more from south of the Mexican border are undescribed. Many of the species are not represented in the United States National Museum or other collections examined by me. With our limited representation of the groups of the genus, it is impossible to make more than a local contribution to a comprehensive phylogenetic study of the species of both continents. In a few groups, such as those that occur on boreal food plants, as willow, the relationship of the species can be outlined, but in other groups chiefly confined to tropical regions, as that to which *glabrata* belongs, a single United States species stands out as isolated and unrelated to any other. The most that can be done in a partial study of this kind is to place the species as far as is possible in groups that ultimately may be assembled in a study of wider scope.

These groups of species have certain characters in common. The head is inserted as far as the eyes, and has a fovea on the vertex on each side near the eye, the fovea being usually surrounded to a greater or lesser extent with punctures. The sculpture of the head offers one of the best characters for separating the groups of species. In the *alternata* group, coarse punctures not only surround the fovea but usually extend over most of the occiput and vertex; in the *discoidea* group, on the other hand, a single large pit or fovea on each side is often the only trace of punctation. In some species, such as *xanthomelas*, the punctures are arranged to form a furrow extending from the fovea to the frontal tubercles. These tubercles are also somewhat variable. They are distinctly defined in most species, and in some groups, as the *alternata* group, they are somewhat swollen, while in *latifrons* they are so flat as to be scarcely distinct. The area between the antennal sockets tends to be carinate, although not much produced. In many species, as in *triangularis*, this carina is quite acute, while in others, as in *tenuicornis* and *funerea*, the interantennal area is broad and flat. The carina extends well down the lower front, joining the frontal margin. The antennae, differing somewhat in length according to the sex, those of the male being a little longer, usually do not extend beyond the middle of the elytra, and the third joint is shorter than or subequal to the fourth. In the female, the eighth, ninth, and tenth antennal joints are slightly shorter and slenderer than in the male.

The shape of the prothorax differs greatly in different groups. In general, the prothorax is nearly the same width as the elytra, approximately twice as broad as long, sometimes more, and occasionally a little less. It is slightly narrowed anteriorly with a more or less arcuate, narrow, sharp-edged, lateral margin, much narrower than in *Oedionychis*. The basal margin is somewhat sinuate, with the hind angles obliquely truncate. In some groups of species, as the *pensylvanica* and *alternata* groups, the pronotum is not very convex, and there are lateral callosities and a slight median basal depression, while in others, as the *discoidea* and *fumata* groups, the pronotum is smooth, convex, and without depressions.

The elytra are either oblong with parallel sides or oval with rounded sides. The humeri vary in prominence, and are often marked by a short sulcus on the inner side, referred to in the descriptions of the species in this paper as an intrahumeral sulcus or depression. In the *pensylvanica* and *alternata* groups, there is a distinct tendency toward elytral ridging in the female, the costae sometimes extending from the humeri nearly to the apex. There is always a narrow lateral explanate margin, not extending to the apex, and beneath, the epipleura gradually narrow to the apex. The elytra are not striate, but confusedly and never very coarsely punctate.

They are smooth, except in the costate species, usually shining and glabrous. The prosternum divides the coxae, and the precoxal cavities are open behind. The last visible sternite in the male is truncate and in the female angulate. The legs are relatively short and the tibiae feebly sulcate on the outer edge with a short apical spur. In the male the first joint of the anterior tarsi is much enlarged. The claws have a short basal tooth.

The shape of the aedeagus corroborates the other structural characters by which the species are separable into groups. In the vittate species the shape of the aedeagus is of much greater value in distinguishing relationships than is the coloration. The aedeagi of the species with blue or green elytra are quite unlike those of any of the vittate species except *D. maritima*, a species structurally unique among the vittate ones. The aedeagi of these dark species offer excellent specific differences. The aedeagus of *D. funerea* also is quite unlike that of any other species. It is so difficult to describe the shape of this structure that little has been attempted in the text, but figures showing the dorsal, ventral, and lateral views have been made and should be consulted in determining the species.

The coloring is fairly constant within a species. In the vittate yellow and black species, the head may be pale, bicolored, or entirely dark. The pronotum of the vittate species usually has at least traces of 2 to 5 spots, which sometimes coalesce or band together. The elytra usually have dark sutural, median, and submarginal or marginal vittae. In some groups, as the *discoidea* group, the submarginal vitta is either very faint or lacking. The median and sutural vittae are usually present except in pale varieties of a species, in which they may become interrupted or disappear. Only 1 or 2 pale species north of Mexico are without elytral vittae—*antennata*, an entirely pale Mexican species occurring only at the tip of Florida, and *figurata*, also a Mexican species, found in this country in Arizona and Nevada, in which the vittae are frequently indistinct. The species having blue or green elytra are nearly as homogeneous in coloration as the vittate species. The former can be distinguished from one another by the color of the head, femora, and lower surface, which may be pale, bicolored, or dark. Only one, *funerea*, is entirely dark except for the last ventral segment, and this species is structurally unlike the others.

DESCRIPTION OF THE GROUPS

Since 10 of the 32 species found in the United States do not fall into any natural group known to me, and since 3 of the others are the only representatives of 2 southern groups, I have not been able to work out a satisfactory natural key according to these groups. In lieu of this, a short discussion of the groups is here given, with

a more artificial but all-inclusive key, based mainly on color differences, appended for practical use in the identification of the species.

The first group, the *pensylvanica* group, is composed of 5 northern species, *pensylvanica*, *conjugata*, *procera*, *uniguttata*, and *limbicollis*, and at least 1 Mexican and Central American species, *recticollis*. All of them feed on *Polygonum*. They are slender, oblong insects with parallel sides, often with the dark elytral vittae broader than the pale ones, and with the head and under surface more or less darkened. The pronotum is usually uneven and the elytra of the female distinctly costate. The aedeagi are quite unlike one another in the shape of the dorsal tip, but the differences are more a matter of degree than of radical change in shape.

The second group, the *alternata* group, is composed of four northern species, *alternata*, *pluriligata*, *latiovittata*, and *schaefferi*, and a fifth, *teapensis*, described from Teapa, Mexico. The first four are known to feed on willow. These are the largest of the genus (6 to 8 mm) and are broadly oblong with parallel sides. The head is usually coarsely punctate and, as in the *pensylvanica* group, but to a less degree, the pronotum is uneven and the elytra of the female show traces of costation. The aedeagi differ in the shape of the tip but their differences, as in the *pensylvanica* group, are merely relative.

The third group, the *fumata* group, is composed of two species, *fumata* and *latifrons*, each with several geographic races. As far as known, they feed on *Aster* and *Solidago*. They are more oval in shape than the preceding groups, with smooth, not depressed or uneven, prothorax, and with no traces of elytral costae. The aedeagi of both species are very similar, but the tip in *latifrons* is wider.

The fourth group, the *discoidea* group, is composed of three closely related United States species, *discoidea*, *leptolineata*, and *antennata*, as well as the still undistinguished Mexican and Central American species that were called *abbreviata* Melsheimer in the *Biologia Centrali-Americana*. Except for *discoidea*, which feeds on *Passiflora* sp., the food plants of this group are unknown. The species, while differing greatly in markings, are so similar in structure that it is not easy to determine their specific differences. They may be but varieties of one species. All are broadly oval in shape with smooth, undepressed upper surface, the head is nearly impunctate, having a large fovea near each eye, and the pronotum is smooth and usually unspotted, and all either entirely lack the submarginal elytral vitta or show only faint traces of it. The aedeagi are so much alike as to be hardly distinguishable.

The fifth group is composed of species that have blue or green elytra and that feed on *Amaranthus* and *Chenopodium*, and consists

of *triangularis*, *xanthomelas*, *collata*, *politula*, and probably *semicarbonata*, and several more Mexican and Central American species. *D. laevigata*, known in the West Indies as a garden pest, also belongs to this group of feeders on *Amaranthus*. They are small, oval insects frequently with lustrous elytra. In spite of their similarity in coloring, they differ considerably among themselves and have quite dissimilar aedeagi that do not resemble one another or the aedeagi of the vittate species.

The remaining 13 species are too distinct to fall readily into groups. Three of them, *glabrata*, *varicornis*, and *stenosticha*, are closely related to Mexican and Central American species.

D. glabrata has two close relatives, *nigrita* and *dorsata* Jacoby, the latter with entirely dark elytra. The species *glabrata* and *dorsata* are unlike the other vittate species, except *maritima*, in having, in their well-marked and typical form, a dark elytral margin. *D. glabrata* and its two close relatives are smooth and shining and have a similarly shaped and similarly marked prothorax. Their aedeagi are nearly indistinguishable. *D. glabrata* feeds on *Amaranthus*, as do the members of the fifth group. In shape these three species appear more closely allied to the fifth group than to the vittate groups.

D. varicornis, occurring in Texas and southern California, and feeding on *Opuntia*, is closely related to *mexicana* Jacoby, although the aedeagi are not alike. Both species have blue elytra but are unlike the rest of the similarly colored species in having a narrower head and prothorax with a broadened apical angle to the explanate margin and with an unusual notching behind the angle.

D. stenosticha is closely related to (if not identical with) *militaris* Jacoby, a Mexican and Central American species.

The remaining 10 species, which are not closely related to any others known to me, are: *punctigera*, *caroliniana*, *tenuicornis*, *figurata*, *arizonae*, *alabamiae*, *admirabilis*, *brevicornis*, *maritima*, and *funerea*.

GEOGRAPHIC VARIATION

On the Pacific coast there are representatives of only two groups of the vittate species of *Disonycha*, namely, the *alternata* and *pennsylvanica* groups, and the unique species *maritima*, which is not like any other known to me. *D. varicornis*, a species with blue elytra, reaches the Pacific coast, but is known only from Texas, southern California, and Lower California. All the other species of *Disonycha* are found east of the Rocky Mountains. Many species have a far wider range than has been supposed. As may be expected, species that range from New York to Arizona, such as *arizonae* and *latifrons*, show some variation in their different environments. This may be in size, in coloration, and even in punctuation, and it has led entomologists to describe as distinct species what are in real-

ity simply geographic races. The Atlantic coast specimens of *glabrata*, *arizonae*, *procera*, *fumata*, and *latifrons* are obviously different from the Arizona or Colorado ones, being either paler or darker in color, usually larger, and, in *glabrata* and *arizonae*, having deeper punctation; but specimens from intermediate localities are intermediate, and throughout the series the structural characters and aedeagus remain the same, so that the difference must be considered only varietal.

In other species of the genus the change in characters correlated with distribution has apparently gone a step further and becomes so great that distinct species have arisen. Such is the case in *limbicollis*. This species, which is confined to the Pacific coast, is plainly very closely related to *uniguttata*, and probably derived from it, but has developed certain distinctive characteristics that appear to be specific. This may be the case, also, in *latiovittata*, which occurs only in the Pacific and Northwestern States, and which is closely related to *alternata*.

In the *discoidea* group there seems to be an intermediate stage in the development of species. In this group the differences in coloration of specimens are very striking, but the shape, sculpture, aedeagus, and other structural characters are so similar that, aside from the coloring, the forms are difficult to differentiate. Possibly they are but varieties of a single species. *D. leptolineata* from Florida and *texana* from Texas, both closely related to *discoidea*, are doubtfully distinct. *D. antennata*, an entirely pale beetle, would be indistinguishable were it not for its entire lack of elytral vittae.

Some of the species with blue or green elytra, such as *xanthomelas*, *triangularis*, and *collata*, are widely distributed. In both *xanthomelas* and *collata* there is considerable variation in color, size, and degree of punctation, with the result that in each case two forms, based primarily on color differences and not structurally separable, have been described as species.

LIFE HISTORY

The life histories of four species of *Disonycha* have been published. F. H. Chittenden has given an admirable account of the eggs, larvae, and feeding habits of *xanthomelas*¹⁶ and a shorter account of the life history of *collata* (*mellnicollis*)¹⁷ and also *glabrata*.¹⁸ H. Garman¹⁹ has also written a full account of the life history of *glabrata*. W. E. Whitehead²⁰ has made a careful study of the life history of *latifrons*.

¹⁶ Chittenden, U.S. Bur. Ent. Bull. 19, p. 80, 1899.

¹⁷ Chittenden, U.S. Bur. Ent. Bull. 82, p. 29, 1912.

¹⁸ Chittenden, Bull. Brooklyn Ent. Soc., vol. 17, p. 147, 1922.

¹⁹ Garman, 2d Ann. Rep. Kentucky Agr. Exp. Sta., p. 28, 1889.

²⁰ Whitehead, Nova Scotia Ent. Soc. Proc., 1918, p. 38.

The insect hibernates as an adult, and early in spring lays eggs in groups on its food plant or the nearby soil. In Nova Scotia, according to Whitehead, the eggs of *latifrons*, laid in April and May, did not hatch till June, while in Washington, D.C., the eggs of *xanthomelas* hatched in a week or 10 days, according to the temperature. Likewise the larval stage of *latifrons* in Nova Scotia was much longer, lasting from 50 to 55 days, and the pupal stage from 34 to 40 days. In the case of *latifrons*, the adult after emerging fed "voraciously for a month or 6 weeks and then entered the ground, vegetable matter, or rotten stumps where it hibernated." In more southern latitudes, as at Washington, D.C., or in Kentucky, the larval period is much shorter. In the case of *xanthomelas* and *glabrata*, it was only 3 or 4 weeks, and the pupal period about 3 weeks. The larvae feed usually on the lower surface of the leaves, often gregariously, at first eating holes and later stripping the leaves. When full grown they enter the ground to pupate. The number of generations of beetles probably varies also according to the length of the season.

MATERIAL EXAMINED

I have been fortunate in having a large series of most of the species to study at the United States National Museum, including many of Schaeffer's types. Besides this, I have had access to the LeConte, Blanchard, and Bowditch collections at Cambridge. I wish to thank the following who have sent me material for study: K. G. Blair, of the British Museum; E. T. Cresson, Jr., of the Academy of Natural Sciences of Philadelphia; Dr. T. H. Frison, of the Illinois State Natural History Survey; Prof. H. B. Hungerford and Warwick Benedict, of the University of Kansas; Prof. E. C. Van Dyke and E. P. Van Duzee, of the California Academy of Sciences; Prof. W. E. Whitehead, of MacDonald College; and C. A. Frost, Ralph Hopping, D. K. Duncan, H. R. Brisley, F. S. Carr, and H. P. Loding. I am also indebted to Dr. W. G. Kuntzen, of the Berlin Zoological Museum, and K. G. Blair, of the British Museum, for comparing specimens with type collections, and to H. S. Barber for his painstaking criticism.

KEY TO THE SPECIES OF DISONYCHA

- | | |
|---|-------------------------|
| 1. Elytra unicolorous, not vittate..... | 2 |
| Elytra vittate, with dark margin..... | 11 |
| Elytra vittate or with discoidal median spot, margin always pale..... | 12 |
| 2. Prothorax entirely dark..... | <i>funerea</i> (p. 61). |
| Prothorax yellowish, with or without spots or band, margin always pale..... | 3 |
| 3. Elytra yellow or yellow-brown..... | 4 |
| Elytra blue, purple, or green..... | 6 |

4. Prothorax with two dark spots anteriorly, elytra with very indistinct traces of sutural, median, and sometimes submarginal vittae; Arizona.
figurata (p. 35).
 Prothorax entirely pale or with vague reddish markings; North Carolina to Florida----- 5
5. Small (5 mm), elytra costate in female, usually traces of pale reddish pronotal spots, elytra pale reddish (in well-marked specimens paler yellow sutural, median, and marginal vittae); North Carolina to Florida.
conjugata (p. 14).
 Larger (6 to 7 mm), elytra not costate, entirely pale yellow, no trace of vittae; Florida Keys----- *antennata* (p. 46).
6. Head entirely pale, apical angle of lateral margin of prothorax unusually broad and notched behind the apex on margin; Texas, southern California.
varicornis (p. 60).
 Head entirely dark or bicolored----- 7
7. Head entirely dark----- 8
 Head bicolored----- 9
8. Head coarsely and densely punctate, ventral surface and legs entirely dark.
triangularis (p. 57).
 Head smooth, or with a few punctures across occiput and front, abdomen usually with pale margin or pale last ventral segment, sometimes entire abdomen pale, femora often pale at base----- *xanthomelas* (p. 55).
9. Femora bicolored, elytra very lustrous and densely punctate.
politula (p. 59).
 Femora pale, elytra not so lustrous and not densely punctate----- 10
10. Prothorax and elytra distinctly punctate; New Mexico and Colorado.
semicarbonata (p. 54).
 Prothorax and elytra finely and often indistinctly punctate; Kansas eastward----- *collata* (p. 52).
11. Shining, indistinctly punctate, femora and margin of abdomen usually pale; Atlantic coast to Arizona----- *glabrata* (p. 49).
 Only feebly shining, coarsely punctate, femora and abdomen dark; California and Nevada----- *maritima* (p. 51).
12. Elytra with broad discoidal dark spot----- *discoidea* (p. 43).
 Elytra vittate----- 13
13. Elytra pale with pale reddish or obsolete grayish vittae----- 14
 Elytra pale with dark brown or black vittae----- 15
14. Large (6 to 7 mm), elytra with obsolete or grayish vittae, no traces of costae, prothorax with 2 dark spots; Arizona, Nevada----- *figurata* (p. 35).
 Smaller (5 mm), elytra with pale reddish vittae, markedly costate in female, prothorax usually with pale reddish spots; North Carolina to Florida.
conjugata (p. 14).
15. Elytra with sutural and submarginal vittae, no median vitta or only traces of it----- 16
 Elytra with sutural and median vittae, no submarginal vitta or only indistinct traces of it----- 17
 Elytra with sutural, median, and submarginal vittae----- 21
16. Head pale except for narrow occipital band, tubercles sometimes dark and labrum usually brown----- *alternata* (p. 20).
 Head dark except about antennal sockets and sometimes a pale streak on lower edge of clypeus----- *limbicollis* (p. 19).
17. Prothorax without spots----- 18
 Prothorax spotted----- 19

18. Elytra distinctly punctate----- *discoidea* var. *abbreviata* (p. 44).
 Elytra very indistinctly punctate----- *leptolineata* (p. 44).
19. Head entirely pale, antennae unusually long and slender, extending fully to the middle of the elytra in female----- *tenuicornis* (p. 32).
 Head with labrum and sometimes tubercles and occiput dark, antennae not unusually long or slender and not extending to the middle of the elytra in female----- 20
20. Prothorax with distinct lateral callosities, head coarsely punctate.
pluriligata (p. 25).
 Prothorax smooth, head smooth and shining except for a group of coarse punctures about fovea on each side----- *figurata* (p. 35).
21. Head entirely pale (sometimes tip of mandibles darkened)----- 22
 Head either entirely dark, or pale with occiput, tubercles, or labrum dark----- 24
22. Pronotum not distinctly spotted, elytra polished and with very narrow vittae, the sutural and submarginal vittae pale and somewhat indistinct; southern Texas----- *stenosticha* (p. 63).
 Pronotum distinctly marked with two anterior spots, elytra not polished, the vittae distinct and not unusually narrow----- 23
23. Antennae long and slender, extending beyond the middle of the elytra, elytra broadly oblong; Arizona----- *tenuicornis* (p. 32).
 Antennae not unusually long, scarcely reaching the middle of the elytra; elytra oblong oval; Massachusetts to Texas----- *caroliniana* (p. 33).
24. Head entirely dark except at base of antennal sockets----- 25
 Head not entirely dark----- 27
25. Small (5 to 6 mm), elytra markedly costate in female, very indistinctly punctate (see also description of dark variety of *procera*).
pensylvanica (p. 12).
 Larger (6 to 8 mm), elytra with only traces of costae in female, distinctly punctate----- 26
26. Aedeagus dark (see pl. 1, fig. 5); California----- *limbicollis* (p. 19).
 Aedeagus paler and slightly different in shape (see pl. 1, fig. 4); east of Rocky Mountains----- *uniguttata* (p. 17).
27. Prothorax more or less uneven, with lateral callosities, elytra more or less costate in female----- 28
 Prothorax always smooth and without depressions or callosities, elytra never costate in female----- 34
28. Head not densely or rugosely punctate, and with a broad dark occipital band extending to and often covering tubercles----- 29
 Head densely and usually rugosely punctate, and with at most only a narrow dark occipital band or spot, never extending to tubercles----- 30
29. Aedeagus with ventral lip tapering and acute (see pl. 8, fig. 42); Colorado.
brevicornis (p. 62).
 Aedeagus with ventral lip broad, not tapering (see pl. 1, fig. 3); Atlantic coast to Rocky Mountains and Oregon----- *procera* (p. 15).
30. Prothorax densely and coarsely punctate; Pacific and Northwestern States.
latiovittata (p. 23).
 Prothorax not so densely and rather indistinctly punctate----- 31
31. Elytra densely and sometimes confluent punctate----- 32
 Elytra not densely and not confluent punctate----- 33
32. Prothorax with distinct lateral callosities, not very convex, elytra coarsely and confluent punctate----- *schaefferi* (p. 24).
 Prothorax without distinct lateral callosities, convex, elytra densely but not so coarsely and not confluent punctate----- *punctigera* (p. 28).

33. Aedeagus with an acutely pointed dorsal tip (pl. 2, fig. 8) — *alternata* (p. 20).
Aedeagus with a broad dorsal tip (see pl. 2, fig. 9) — *pluriligata* (p. 25).
34. Median elytral vitta near submarginal vitta, with very narrow pale space between — *alabamæ* (p. 47).
Median elytral vitta not conspicuously nearer to submarginal vitta than to sutural vitta — 35
35. Head with interantennal area and tubercles flat and smooth, tubercles not at all swollen, and indistinct — *latifrons* (p. 40).
Head with frontal carina and tubercles distinct — 36
36. Head, viewed from above, with interocular space half width of head — 37
Head, viewed from above, with interocular space more than half width of head — 38
37. Prothorax either entirely pale or with small median spot, occasionally with median spot and 2 lateral spots, all small, antennal joints not unusually long — *glabrata* (p. 49).
Prothorax with 2 anterior spots usually well marked, and often 2 lateral ones and median stripe; antennal joints 4 to 7 unusually long and subequal — *fumata* (p. 36).
38. Elytra distinctly and rather densely punctate — 39
Elytra indistinctly and finely but not densely punctate — 40
39. Submarginal elytral vitta never reaching apex to join with sutural vitta; aedeagus broad (see pl. 3, fig. 11) — *punctigera* (p. 28).
Submarginal elytral vitta joining at apex with sutural vitta; aedeagus narrow (see pl. 3, fig. 13) — *arizonæ* (p. 29).
40. Head with broad dark occipital band, pronotum heavily marked with spots, the middle three sometimes coalescing, the lateral spots large; Colorado. *brevicornis* (p. 62).
Head never with occipital band, pronotum never with well-marked lateral spots — 41
41. Small (5 to 6 mm), usually without pronotal spots; Atlantic coast to Great Plains — *admirabilis* (p. 48).
Larger (6 to 7 mm), prothorax with 2 well-marked anterior dark spots; southern Arizona — *figurata* (p. 35).

DESCRIPTION OF SPECIES

1. *DISONYCHA PENNSYLVANICA* (Illiger)

PLATE I, FIGURE 1

Haltica pensylvanica ILLIGER, Mag. für Insekt., vol. 6, p. 146, 1807 (Pennsylvania; type in Berlin University Zoological Museum).

?*Galleruca scrlincata* OLIVIER, Entomologie, vol. 6, p. 642, 1808 (Bengal).

Disonycha pensylvania STRUM, Catalogue, p. 283, 1943.—BLAKE, Bull. Brooklyn Ent. Soc., vol. 25, p. 210, 1930.

Disonycha pensylvanica CROTCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873.—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 202, 1889 (in part).

Disonycha pensylvanica var. *parva* BLATCHLEY, Journ. New York Ent. Soc., vol. 29, p. 16, 1922 (Knox County, Ind.).

Description.—Small (5 mm), elongate oblong oval, shining, very finely punctate; elytra costate in female; head, legs, and body beneath dark except sides of prosternum and last ventral segment; prothorax with a single median spot, this sometimes broadening to

a wide band, elytra with wide and dark sutural, median, and submarginal vittae. Head with interocular space more than half width of head; frontal tubercles well marked, carina narrow, somewhat produced; surface smooth and shining, except a deep fovea surrounded by coarse punctures on each side near eye; usually entirely dark except the base of the antennae, but sometimes a narrow pale streak along lower edge of front. Antennae long (for the genus), dark, third and fifth joints subequal and shorter than fourth. Prothorax about twice as wide as long, nearly rectangular, with sides only slightly arcuate, not very convex and with a slight basal median depression; surface somewhat shining, under high magnification finely alutaceous and indistinctly punctate; pale with median dark spot, this sometimes broadening to form a wide band across pronotum, leaving margin always pale. Scutellum dark. Elytra oblong oval with parallel sides; not very convex, humeri marked by short intrahumeral sulcus; in the female 3 or 4 costae on each elytron, not so long or so prominent as in *conjugata*, these costae not apparent in the male; surface smooth, somewhat shining, under high magnification indistinctly alutaceous, and very finely punctate; pale with very broad sutural, median, and submarginal vittae, the submarginal and sutural usually broadly united at apex, the paler intervening vittae much narrower than the dark ones. Body beneath finely pubescent and entirely dark except the sides of the prosternum and the last ventral segment, sometimes margin of the penultimate segment also pale. Length, 5 to 6 mm; width, 2.8 to 3 mm.

Type locality.—Pennsylvania.

Distribution.²¹—Massachusetts (Framingham, Nantucket); New Jersey (Boonton); Maryland (Glen Echo); Virginia (Fredericksburg, Norfolk); North Carolina (Chadbourn); Florida (Bradenton, Capron, Crescent City, Daytona, Enterprise, Lake Harney, Lakeland, Key West); Illinois (Pulaski, Running Lake, Urbana); Alabama (Mobile); Louisiana (Mandeville, New Orleans); Texas (Avery, Dayton, Mineola).

Food plant.—*Polygonum* sp. (C. W. Johnson).

Remarks.—Although Illiger's description of *pensylvanica* is unusually detailed and definite, this species has long been confused with two larger species, *uniguttata* and *procera*. It is usually smaller and darker than either of these, having an entirely dark head and legs, and the undersurface, except the last one or two ventral segments and sides of prosternum, is entirely dark. Unlike *uniguttata*, it has the elytral punctation very fine and indistinct. No specimens are yet known from west of the Mississippi River except in Louisiana and Texas.

²¹ The statements of distribution are based on specimens examined by the author.

The illustration and description of *Galleruca scalincata* in Olivier's Entomologie are suggestive of this species, but the habitat given is Bengal. Apparently Chevrolat in the Dejean Catalogue suspected that this species might be a North American *Disonycha*, since he lists it with a question mark. He had previously listed it in D'Orbigny's Natural History under *Disonycha*, and there is an old specimen of this species in the Bowditch collection that is labeled "*6-lineata* Oliv." followed by what appears to be the abbreviation "Ch."

Dr. W. G. Kuntzen, of Berlin University Zoological Museum, has corroborated my interpretation of the species by comparing specimens sent by me with the Illiger type.

2. DISONYCHA CONJUGATA (Fabricius)

PLATE 1, FIGURE 2

Galleruca conjugata FABRICIUS, Systema Eleutheratorum, vol. 1, p. 495, 1801 (Carolina; Mus. Bosc.).

Haltica conjugata ILLIGER, Mag. für Insekt., vol. 6, p. 184, 1807.

Altica conjugata OLIVIER, Entomologie, vol. 6, p. 686, 1808.

Disonycha conjugata CHEVROLAT, Dict. Univ. d'Hist. Nat., vol. 5, p. 81, 1849.—BLAKE, Bull. Brooklyn Ent. Soc., vol. 15, p. 211, 1930.

Monomacra costipennis JACQUELIN DU VAL, in Sagra's Hist. Fís. Cuba, vol. 7, p. 129, 1857 (Cuba).

Disonycha floridana JACOBY, Entomologist, vol. 34, p. 146, 1901 (St. Johns Bluff, east Florida; type in British Museum).

Disonycha pennsylvanica var. *conjugata* HORN, Trans. Amer. Ent. Soc., vol. 16, p. 203, 1889.

Description.—Small (5 mm), elongate oblong-oval, not very shining; elytra in female always markedly costate, less so in male; pale reddish yellow with paler yellow narrow elytral vittae; antennae, labrum, mesosternum and metasternum, sometimes middle of abdomen, tibiae and tarsi dark. Head with interocular space more than half width of head; frontal tubercles well marked, carina somewhat produced; surface smooth and shining except for a circle of coarse punctures about the fovea on each side of head near eye; labrum dark, occiput darker reddish. Antennae robust and long (for the genus), dark with paler basal joints; third joint shorter than fourth and fifth, which are subequal, the fourth being slightly longer. Prothorax about twice as wide as long, nearly rectangular in shape, with sides only slightly arcuate; not very convex, with slight lateral callosity and median basal depression; surface smooth and somewhat shining, under high magnification finely alutaceous and nearly impunctate; pale, usually with five indistinct pale reddish spots. Scutellum pale. Elytra narrowly oblong oval, with sides parallel and humeri marked by short intrahumeral sulcus; in female four or five costae extending from humeri well down toward apex, these costae less distinct or obsolete in male; surface somewhat shining, under high magnification very finely alutaceous and punctate; pale yellow with wide pale

reddish sutural, median, and submarginal vittae, these vittae so wide as to leave only narrow intervening vittae, the submarginal and sutural usually uniting at apex. Body beneath finely pubescent, pale with mesosternum and metasternum and often middle of abdomen dark; tibiae and tarsi also dark. Length, 4.4 to 5.5 mm; width, 2.2 to 3 mm.

Type locality.—"Carolina" (Bosc collection).

Distribution.—North Carolina, Georgia, Florida (Bradenton, Capron, Enterprise, Fort Myers, Jacksonville, Lake Harney, Lakeland, Lee County, Lake Poinsett, Miami, Moore Haven, Orlando, Paradise Key, Sanford); Cuba (Habana).

Food plant.—*Polygonum* sp. (H. S. Barber).

Remarks.—*D. conjugata*, one of the earliest species of *Disonycha* to be described, has been published under a number of names. Fabricius described it from a collection by Bosc from "Carolina" as *conjugata*. Old specimens in the LeConte collection and elsewhere are labeled with a Dejean Catalogue name signifying its reddish color. Jacquelin du Val described it from Cuba as *Monomacra costipennis*. Jacoby later described it from Florida as *floridana*, and it has been treated as a variety of *pennsylvanica* by Horn. Its yellowish or pale reddish elytra readily distinguish it from any other species of *Disonycha*. It is closely related to *D. pennsylvanica*.

3. DISONYCHA PROCERA Casey

PLATE 1, FIGURE 3

? *Haltica vicina* KIRBY, Fauna Boreali Amer., vol. 4, p. 217, 1837 ("Lat. 65°", Canada; type lost).

? *Disonycha limbicollis* var. *pallipes* CROUCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873 (type locality not recorded; type lost).

Disonycha proccra CASEY, Contributions, pt. 2, p. 182, 1884 (Milford, Del.; type, U.S.N.M. No. 49223).—SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 282, 1931.

Disonycha pennsylvanica HORN, Trans. Amer. Ent. Soc., vol. 16, p. 202, 1889 (in part).

Disonycha pallipes BLAKE, Bull. Brooklyn Ent. Soc., vol. 25, p. 212, 1930 (not Crotch?).

Disonycha nigriventris SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 282, 1931 (Blitzen River, Oreg.; type in collection of Charles Schaeffer).

Description.—Elongate oblong-oval, somewhat shining; head usually with pale front, pronotum sometimes entirely pale, or in dark variety with five more or less coalescent spots; elytral vittae wide; femora and margin of abdomen usually pale except in dark western and southern specimens, in which the femora are sometimes entirely dark or partially dark. Head with interocular space more than half width of head; frontal tubercles well marked; carina slightly produced; surface usually smooth and shining, except a circle of coarse punctures about fovea on each side near eye and sometimes a fovea

in middle of vertex; dark with pale lower front, the tubercles, carina, and region about base of antennae paler. Antennae dark with paler basal joints, third and fifth joints subequal and shorter than fourth. Prothorax about twice as wide as long, almost rectangular, with sides slightly arcuate, not very convex, a slight trace of lateral callosity and median basal depression; surface finely alutaceous and finely punctate; often entirely pale, but in darker specimens with five spots, these sometimes banded together. Scutellum usually dark. Elytra with sides parallel, humeri marked by short intrahumeral sulcus; in female 4 or 5 costae, usually not so long or prominent as in *conjugata*; surface finely alutaceous and finely and rather sparsely punctate; wide sutural, median, and submarginal vittae, not united at apex. Body beneath finely pubescent, dark with margin of abdomen pale; femora usually pale, but in some specimens from Louisiana, Texas, Utah, Idaho, and Oregon the femora and abdomen dark or partially darkened. Length, 5.6 to 6.8 mm; width, 2.6 to 3 mm.

Type locality.—Milford, Del.

Distribution.—Maine (Paris, Wales); New Hampshire (Mount Washington); Massachusetts (Hatfield); New York (Long Island, New York City, West Point, Whiteface); Pennsylvania (Frankford, Hummelstown, North Mount); New Jersey (Clementon); Maryland (Beltsville, Chesapeake Beach, Patuxent River); District of Columbia; Virginia (Clarendon, Dyke, Mount Vernon); Georgia (Augusta); Louisiana (Mandeville, Morgan City, New Orleans); Texas (Beeville, Columbus, Victoria); Michigan (Detroit, Douglas Lake); Indiana (Knox); Illinois (Algonquin, Dubois, East St. Louis, Grass Lake); Minnesota (Fergus Falls, Mora); North Dakota (Bismarck); Kansas (Pawnee County, Reno County, Sylvania); Texas (Houston); Utah; Nevada; Colorado (Littleton); Idaho; Montana (Assiniboine, Gallatin Valley); Oregon (Blitzen River); British Columbia (Vernon); Alberta (Medicine Hat, Cypress Hills, Jenner); Saskatchewan (Oxbow); Manitoba (Aweme); Hudson Bay.

Food plant.—*Polygonum* sp. (D. H. Blake).

Remarks.—*D. procera*, another member of the *pensylvanica* group, is the species that in a previous paper²² I called *pallipes* Crotch. At that time I discussed the insufficiency of Crotch's description of *pallipes*, and based my interpretation of the species chiefly on that of Dr. E. A. Schwarz and Charles Schaeffer, as shown by labeled specimens, as well as on the fact that the species invariably had red legs in the east while *uniguttata* not infrequently had black legs. Mr. Schaeffer has since written me that although he had labeled specimens of the present species *pallipes*, he has of late decided that

²² Blake, Bull. Brooklyn Ent. Soc., vol. 25, p. 212, 1930.

Crotch's *pallipes* is *uniguttata* because of a character in Crotch's key—"thorax * * * with a marked callosity." Crotch's key is not a regularly constructed one with appositional statements, and either *uniguttata* or *procera* can be deduced from it. Therefore it seems best to regard *pallipes* Crotch as a doubtful species and apply Casey's name *procera* to the species under discussion.

This species, the type of which is a female, corresponding exactly to Casey's description, is usually smaller than *uniguttata* and has much finer punctation. The elytral costae are well developed in the female, which is not true of *uniguttata*. The prothorax has a slight trace of lateral callosity as in both *pennsylvanica* and *conjugata*, but this is not so well developed as in *uniguttata*. In markings it is very similar to *uniguttata*; the head is bicolored, the elytral vittae are wide, the legs and margin of the abdomen are red. The pronotum, however, in eastern specimens is often entirely pale, or with five indistinct spots. There is a dark variety of this species occurring in the Rocky Mountains and Northwestern States and also in Louisiana and Texas, in which the spots on the pronotum are often banded together, and the legs and undersurface are frequently dark or partially dark. These specimens are difficult to distinguish from *pennsylvanica* except by comparison of the aedeagi. Mr. Schaeffer has described this dark form as *D. nigriventris*, one paratype of which, a male, is in the United States National Museum. He states that the aedeagus is different from anything figured by me, but a dissected specimen that he has sent me shows that the aedeagus is not different from that of the eastern specimens of *procera*. My drawings of the aedeagi have been made for the most part from material soaked in caustic potash (which causes the softer membranes to become swollen), and later mounted in balsam. Mr. Schaeffer's dried specimen differs from the specimens mounted in balsam in being less swollen, owing to the different methods of preparation.

4. DISONYCHA UNIGUTTATA (Say)

PLATE 1, FIGURE 4

Altica uniguttata SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 4, p. 88, 1824 (United States; type lost).

? *Haltica vicina* KIRBY, Fauna Boreali Amer., vol. 4, p. 217, 1837 ("Lat. 65°", Canada; type lost).

Disonycha uniguttata MELSHEIMER, Catalogue, p. 122, 1858.—BLAKE, Bull. Brooklyn Ent. Soc., vol. 25, p. 212, 1930.—SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 282, 1931.

? *Disonycha limbicollis* var. *pallipes* CROTCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873 (type lost).—SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 282, 1931.

Disonycha pennsylvanica HORN, Trans. Amer. Ent. Soc., vol. 16, p. 202, 1889 (in part).

Description.—Elongate oblong oval, somewhat shining; elytra distinctly punctate; head sometimes entirely dark but usually pale in region about antennal sockets and lower front, pronotum usually with large median spot and two paler brown lateral spots, these sometimes banded together; elytra with wide sutural, median, and submarginal vittae, usually margin of abdomen and femora pale, but these sometimes also dark. Head with interocular space more than half width of head, frontal carina narrowly produced, tubercles well marked; surface generally smooth except for the coarse punctures about fovea on each side near eye and often a fovea in middle of vertex; usually black with a paler area about antennal sockets and lower front and a median dark streak on carina. Antennae dark with paler basal joints, robust, long for the genus, third joint shorter than fourth or fifth, which are subequal, the fourth slightly longer. Prothorax about twice as wide as long, slightly narrowed anteriorly with arcuate sides; not very convex, with a prominent callosity on either side and a median basal depression; surface alutaceous and finely punctate; pale, usually with a large median spot, wider anteriorly, and two paler lateral spots, sometimes all coalescing to form a wide band across pronotum, sometimes the lateral spots vanishing. Scutellum dark. Elytra with sides parallel, humeri marked by short intrahumeral sulcus; in female sometimes traces of costae, but these not so pronounced as in *conjugata*; surface alutaceous and distinctly and rather densely punctate; dark elytral vittae considerably wider than intervening pale one, the sutural and submarginal rarely united at apex. Body beneath finely pubescent, sometimes undersurface and legs entirely dark, but usually abdomen with a pale margin and femora pale. Length, 5.8 to 8 mm; width, 2.2 to 3.8 mm.

Type locality.—United States.

Distribution.—Massachusetts (Chicopee, Hopkinton, Natick, Wayland, Weston); Rhode Island (Watch Hill); New York (Staten Island, Whiteface); New Jersey (Boonton, Palisades); Pennsylvania; District of Columbia; Virginia (Arlington); Tennessee; Kentucky; Georgia; Florida (Gainesville); Louisiana (New Orleans); Michigan (Detroit, Monroe); Indiana (Hessville, Osborne, Pine); Illinois (Algonquin, Chicago, Devils Neck, Flag Lake, Forest City, Grass Lake, Griggsville, Havana, Normal, Quincy, Thompson Lake, Urbana); Wisconsin (Madison); Iowa (Ames); Missouri (Flat River, Kansas City, St. Louis); Kansas (Douglas County, Topeka); Nebraska; Manitoba (Treesbank, Winnipeg).

Food plant.—*Polygonum* sp. (C. A. Frost).

Remarks.—This species has been commonly called *pensylvanica* (usually but not originally spelled "*pennsylvanica*") but, although

allied to that species, it is a considerably larger insect with pronounced pronotal callosities and with distinctly punctate elytra. In coloring it usually differs from *pennsylvanica* in having a pale lower front, pale femora, and a pale margin to the abdomen, as well as three pronotal spots. Although Say gave as type locality the "United States", he described it in a paper on the insects collected on an expedition to the Rocky Mountains, and it was probably collected somewhere along the Platte River.²³ I have seen no specimens from west of Kansas and Nebraska. *D. pennsylvanica* is not known to occur west of the Mississippi, except in Louisiana and Texas.

Possibly this is the species that Crotch had in mind in his short description of *pallipes* (see previous discussion under *D. procera*). There is a dark eastern form of this in which the head, femora, and undersurface are entirely dark. It is merely a color form, as both dark and typically colored specimens are found in the same series. It is readily distinguished from the small *pennsylvanica* by its distinct elytral punctation. Say in his original description mentions a dark form as a variety that occurs "near the Rocky Mountains." *Disonycha limbicollis* (LeConte), described from Sacramento, Calif., may be only a dark Pacific coast variety of *uniguttata*, but several minor points of difference have led me to retain it as a distinct species.

5. DISONYCHA LIMBICOLLIS (LeConte)

PLATE 1, FIGURE 5

Haltica limbicollis LECONTE, Reports of explorations and surveys for a railroad route from the Mississippi River to the Pacific Ocean, vol. 9, no. 1, p. 67, 1857; vol. 12, pt. 3, p. 67, 1860 (Sacramento, Calif.; type in LeConte collection, Mus. Comp. Zool.).

Disonycha limbicollis CROUCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873.—BLAKE, Bull. Brooklyn Ent. Soc., vol. 25, p. 212, 1930.

Disonycha pennsylvanica var. *limbicollis* HORN, Trans. Amer. Ent. Soc., vol. 16, p. 202, 1889.

Description.—Elongate oblong oval, somewhat shining, elytra distinctly punctate; head dark, pronotum with a wide black band and pale margin, elytra with sutural, median, and submarginal vittae; undersurface and legs dark. Head with interocular space more than half width of head; carina narrowly produced, frontal tubercles well marked; surface smooth except for coarse punctures on each side about fovea, sometimes a small fovea in middle of vertex; entirely dark except sometimes a pale streak over labrum on lower edge of front. Antennae dark, third joint shorter than fourth or fifth, which are subequal, the fourth slightly longer. Prothorax about twice as wide as long, almost rectangular with sides only slightly arcuate, distinct lateral callosities on each side, and a

²³ See Barber, Ent. News, vol. 39, p. 15, 1928.

median basal depression; finely alutaceous and finely punctate; a broad dark band extending across pronotum leaving only the margin pale. Scutellum dark. Elytra narrowly oblong oval, humeri marked by a short intrahumeral sulcus; surface alutaceous and distinctly and quite densely punctate; dark sutural, median, and submarginal vittae, these not wider than pale intervening vittae; the median dark vitta frequently narrow, interrupted, or, even vanishing; sutural and submarginal vittae not uniting at apex. Body beneath finely pubescent, entirely dark, legs dark. Length, 6 to 8 mm; width, 2.5 to 3.8 mm.

Type locality.—Sacramento, Calif.

Distribution.—California (Lake County, Los Angeles, Los Gatos, Moorland, San Joaquin County, Santa Clara County, Stockton); Nevada (Elko).

Food plant.—*Polygonum* sp.

Remarks.—LeConte described this as similar to but narrower than *pennsylvanica* (probably meaning *uniguttata*), and with the thorax sparsely punctured, the elytra not sulcate, and the yellow vittae broader. In the LeConte collection are four specimens bearing the gilt label indicating their locality as California, one of which is labeled *limbicollis*, and all of which fit LeConte's description. The chief points of difference between *limbicollis* and *uniguttata* appear to be in the generally somewhat narrower shape of *limbicollis*, its uniformly darker head and undersurface, and its slightly narrower elytral vittae, the median one of which is often interrupted or evanescent. The aedeagus is also slightly different. *D. limbicollis* may be only a dark variety of *uniguttata*, but because of its geographic isolation west of the Rocky Mountains, and the fact that *uniguttata* does not seem to be found beyond the Great Plains, it may best be regarded as a distinct species.

6. DISONYCHA ALTERNATA (Illiger)

PLATE 2, FIGURE 8

Haltica alternata ILLIGER, Mag. für Insekt., vol. 6, p. 144, 1807 (Carolina and Pennsylvania; type in Berlin University Zoological Museum).

? *Atlica quinquevittata* SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 4, p. 88, 1824 (Missouri; type lost).

Disonycha alternata STURM, Catalogue, p. 283, 1843.—CROUCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873.

Disonycha quinquevittata HORN, Trans. Amer. Ent. Soc., vol. 16, p. 203, 1889 (in part).

Disonycha quinquevittata var. *punctigera* SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 279, 1931. (Not *D. punctigera* LeConte.)

Description.—Broadly oblong oval, moderately shining; pale, head with labrum, occiput, and usually tubercles brown; pronotum usually 5-spotted, sometimes only 2-spotted, elytra with narrow sutural,

median, and submarginal vittae, the median vitta tending to be evanescent in some specimens from Michigan and Illinois; metasternum and tibiae more or less dark and tarsi dark. Head with interocular space more than half width of head; interantennal space broad and somewhat produced; frontal tubercles well marked; occiput and front usually coarsely and often rugosely punctate; pale, usually with occiput and often tubercles and labrum darkened; labrum in some specimens from North Carolina and Georgia pale. Antennae robust, dark with paler basal joints, third and fifth joint subequal, the fourth slightly longer. Prothorax scarcely twice as wide as long, somewhat convex, with a callosity on either side in basal half and a slight median basal depression; somewhat narrowed anteriorly with arcuate sides; surface somewhat shining, under high magnification minutely alutaceous and finely and moderately densely punctate; pale with two anterior spots usually well marked, lateral ones and median stripe often paler brown, sometimes evanescent. Scutellum dark. Elytra with sides parallel, somewhat convex, humeri well marked with short intrahumeral sulcus; in female on lateral apical half a faint trace of ridging such as occurs in the *pensylvanica* group, but much shorter; surface finely alutaceous, finely and quite densely punctate; vittae narrow, the submarginal and sutural usually rather weakly uniting at apex; the median vitta in specimens from about Lake Michigan often interrupted, sometimes almost entirely disappearing. Body beneath densely and rather coarsely pubescent, pale with metasternum in part darkened, tibiae more or less dark, often pale with apex only dark, and tarsi dark. Length, 6.5 to 8.5 mm; width, 3.5 to 4.5 mm.

Type locality.—"Carolina" (as here restricted).

Distribution.—Maine (Monmouth, Paris); New Hampshire (Canaan Lake, White Mountains); Vermont (Brattleboro, Burlington); Massachusetts (Andover, Chicopee, Framingham, Ipswich, Ludlow, Springfield, Wareham, Wilbraham); Connecticut; New York (Long Island); New Jersey (Clementon); Virginia (Nelson County); North Carolina (Dillsboro); South Carolina (Salem, Columbia, Newry); Tennessee; Louisiana (New Orleans); Illinois (Chicago, Grand Tower, Havana, Kahokia, Metropolis, Muncie, Topeka Beach, Waukegan); Indiana (Millers, Pine, Turkey Run); Ohio (Camp Perry, Columbus, Cincinnati); Michigan (Berrien Springs, Breedsville, Douglas Lake, Lewiston, Marquette, Monroe, Port Huron, Toledo Beach); Minnesota (Lake Pelican, St. Anthony Park); Wisconsin (Baldwin, Elkhorn, Hangen, Madison); South Dakota (Perkins County); Kansas (Douglas County, Ellis County, Hamilton County, Medora, Pawnee County, Rooks County, Russell County, Wichita); Nebraska (West Point); Oklahoma (Cleveland

County); Texas; New Mexico (Las Vegas, Santa Fe); Arizona (Oak Creek Canyon, White Mountains); Nevada (Ormsby County); Wyoming (Cheyenne, Laramie); Utah (American Fork, Coalville); Colorado (Antonito, Denver, Colorado Springs, Fort Collins, Greeley, Poudre Fork); Idaho (Blackfoot, Pocatello); Montana (Assiniboine, Billings, Bozeman, Glendive, Helena, Huntley); California, (Oakdale, Oil City, Kern County, Sacramento, Snelling); Nova Scotia (Truro); Ontario; Manitoba (Aweme, Onah); Saskatchewan; Mackenzie (Mackenzie River); Northwest Territories (Simpson); Alberta (Medicine Hat); British Columbia (Oliver, Osoyoos).

Food plant.—*Salix*.

Remarks.—This is one of the species that have been confused under the name of *D. quinquevittata* (Say) since Horn's revision of the genus. From Say's description of *quinquevittata* from Missouri, it is not clear which of several closely related species he had before him. Both *pluriligata* and the present species are found in Missouri, as well as *punctigera*, and Say's description applies equally well to all three. *D. pluriligata* is found in the Middle and Gulf States and westward but not north of Illinois. I have examined only one specimen from the East and this, labeled College Park, Md., collected by Duckett, is probably mislabeled, as much of Duckett's material was mounted after his death. *D. punctigera* is also a western species, not known east of Illinois. *D. alternata* was described by Illiger as coming "aus Carolina; Bosc d'Antic. Auf verschiednen Gartengewachsen in Pensylvanien; Pred. Melsheimer; Prof. Knoch." Although I have not seen the type of *alternata*, from comparisons made by Dr. W. G. Kuntzen with the Illiger specimens in the Berlin University Zoological Museum I have little doubt that the eastern species commonly called *quinquevittata* (Say) is the species described by Illiger. In the LeConte collection this species bears the label *alternata*. Dr. Kuntzen writes as follows of *alternata*:

Type and three paratypes, surely all the same, Carolina, Bosc d'Antic leg. * * * is in the sense of G. H. Horn (1889) a form of *5-vittata* Say * * * and is similar to the specimens named in the Berlin Museum as *D. punctigera* Leconte from Kansas, Hamilton County 3,350 feet F. H. Snow * * * [specimens of this same series from Hamilton County in the Snow collection have been examined and are what is here identified as *alternata* Illiger] * * * the black stripes of the elytra are narrow, there are only two distal spots on the pronotum, a posterior part of the metasternum of crescent shape is not at all or only a little darkened. Length, 7 to 8.5 mm.

D. alternata is found from Canada to Texas and from the Atlantic coast to British Columbia. In general it is a slightly larger and broader species than *pluriligata*, but so closely resembles it that often only an examination of the aedeagus will enable one to distinguish the two species.

Two specimens from Dillsboro, N.C., and a female in Mr. Schaeffer's collection from Fort Benning, Ga., are slightly smaller and paler, with the labrum pale, the pronotal spots not large, and the elytral vittae narrow. Dissection of the male from Dillsboro, N.C., shows that the aedeagus is identical with the larger and darker northern specimens.

7. DISONYCHA LATIOVITTATA Hatch

PLATE 2, FIGURE 6

Haltica puncticollis LeConte, Reports of explorations and surveys for a railroad route from the Mississippi River to the Pacific Ocean, vol. 9, no. 1, p. 67, 1857; vol. 12, pt. 3, p. 67, 1860 (Oregon and California; type in LeConte collection, Mus. Comp. Zool.) (Not *Haltica puncticollis* Kirby, 1837.)

Disonycha puncticollis Gemminger and Harold, Catalogus coleopterorum, p. 3497, 1876.—Gentner, Can. Ent., vol. 58, p. 149, 1926.

Disonycha quinquévittata Horn, Trans. Amer. Ent. Soc., vol. 16, p. 203, 1889 (in part).

Disonycha quinquévittata var. *puncticollis* Schaeffer, Journ. New York Ent. Soc., vol. 39, p. 280, 1931.

Disonycha latiovittata Hatch, Pan-Pacific Ent., vol. 8, no. 3, p. 108, 1932 (Nisqually, Washington; type in collection M. H. Hatch).

Description.—Broadly oblong oval, feebly shining, prothorax densely punctate; pale, head with labrum and often occiput dark, pronotum with 4 or 5 spots, elytra with sutural, median, and submarginal vittae, usually metasternum in middle, apex of tibiae, and tarsi dark. Head with interocular space slightly more than half width of head; carina not acute, broad and produced, frontal tubercles somewhat swollen, well marked; coarsely and rugosely punctate; pale, with labrum, sometimes also tubercles and occiput, dark. Antennae stout, dark with paler basal joints; third joint shorter than fourth or fifth, which are subequal, the fourth slightly longer. Prothorax twice as broad as long, not very convex, with callosity on each side on basal half and slight median depression near base; somewhat narrowed anteriorly with arcuate sides; surface alutaceous and densely punctate, not shiny; pale, generally with four spots, the median stripe usually either obsolete or reduced to a dot. Scutellum dark. Elytra broadly oblong, sides parallel somewhat convex, humeri well marked, with a distinct intrahumeral sulcus; surface alutaceous, somewhat shining, moderately coarsely and densely punctate; sutural and submarginal vittae usually joined at apex, vittae broad in Washington and Oregon specimens, but often rather narrow in California specimens, and in these the median vitta sometimes interrupted. Body beneath densely pubescent, pale, usually with the middle of metasternum, apex of tibiae, and tarsi dark. Length, 6 to 7.2 mm; width, 3.2 to 3.8 mm.

Type locality.—Nisqually, Wash., collected by Trevor Kincaid, August 23, 1931.

Distribution.—Washington (San Gabriel, Wawawai); Oregon (Corvallis, Freewater); California (Bartlett Springs, Camp Greeley, Castle Crag, Colton, Contra Costa, Dunsmuir, Fresno County, Garden Grove, Hayfork, Isabella, Kaweah, Los Alamitos, Los Angeles, Orange County, Pasadena, Paso Robles, Riverside, Santa Ana River, San Bernardino, San Diego, San Joaquin River, San Jose, Santa Monica, Sacramento, Sierra Nevada, Tulare County, Woyden, Yreka); Wyoming (Yellowstone National Park); British Columbia (Conford).

Food plant.—*Salix*.

Remarks.—The type of *Haltica puncticollis* LeConte is without doubt the specimen in the LeConte collection bearing the name and a gilt label indicating that it was collected in California. It fits LeConte's description, even to the dark coloring in the middle of the metasternum at the base (this coloring is more or less variable, but the entire metasternum is not dark in any specimen examined). Unfortunately, the name *puncticollis* has been previously used by Kirby in describing his *Haltica puncticollis*, which is now regarded as a synonym of *D. triangularis* (Say), and this has necessitated changing LeConte's very applicable specific name. In describing *D. latiovittata*, Hatch suggested that it might be identical with *puncticollis*, but that in any case the latter name was preoccupied. Specimens in the United States National Museum agreeing with his description and from Wawawai, Wash., one of the localities mentioned by Hatch in citing paratype specimens, have been compared by the writer with the type of *D. puncticollis* (LeConte) and found to be identical.

D. latiovittata is one of the species closely related to and usually confused with *alternata*. The aedeagus, however, differs considerably from that of *alternata*, being somewhat intermediate in shape between that species and *pluriligata*. *D. latiovittata* is distinguished by the densely and more coarsely punctate prothorax. The elytra also appear broader and more depressed than in *alternata*. The Washington and Oregon specimens usually have wide black elytral vittae and well-marked pronotal spots, but California specimens do not have unusually wide dark vittae; in fact, the median one is sometimes so narrow as to be interrupted, and the spots on the pronotum are less marked.

8. DISONYCHA SCHAEFFERI, new species

PLATE 2, FIGURE 7

Description.—Elongate oblong-oval, elytra coarsely and densely punctate, feebly shining; pale, head with slightly darkened labrum, often tubercles and occiput dark; prothorax with two well-marked spots anteriorly, and only a trace of lateral and median spots, elytra

with sutural, median, and submarginal vittae, metasternum in part, apex of tibiae, and tarsi dark. Head with interocular space more than half width of head; carina not acute, broad and produced; frontal tubercles somewhat swollen; coarsely and rugosely punctate on each side of front, with middle a little smoother; pale, the labrum, often tubercles, and occiput darkened. Antennae, stout, dark with paler basal joints, third joint shorter than fourth or fifth, which are subequal with the fourth slightly longer. Prothorax not twice as wide as long, somewhat convex, a callosity on either side and slight median basal depression; narrowed anteriorly with arcuate sides; surface alutaceous, moderately coarsely and rather densely punctate; pale with two well-marked anterior spots, the lateral spots and median stripe faint. Scutellum dark. Elytra oblong oval with parallel sides; somewhat convex; humeri well marked with a short intrahumeral sulcus; surface alutaceous, feebly shining, distinctly and densely, often confluent punctate; pale with narrow sutural, median and submarginal vittae, the sutural and submarginal weakly joined. Body beneath densely pubescent, pale with metasternum in part, apex of tibiae, and tarsi dark. Length, 7 to 8 mm; width, 3.6 to 4.2 mm.

Type.—Male and two female paratypes, U.S.N.M. No. 43649.

Type locality.—"Canada" (Wirt Robinson collection.)

Distribution.—"Canada"; Ohio (Cincinnati).

Food plant.—Unknown.

Remarks.—This species is related to *alternata* but easily distinguished from it by the coarse and dense punctation of the elytra. The aedeagus also differs from that of the rest of the *alternata* group, although bearing a resemblance to that of *alternata*. I take pleasure in dedicating this species to Charles Schaeffer, who has studied the genus *Disonycha* for many years. Mr. Schaeffer has sent me for examination from his collection two specimens of this species, both females, with the locality label Cincinnati, Ohio.

9. DISONYCHA PLURILIGATA (LeConte)

PLATE 2, FIGURE 9

?*Altica quinquevittata* SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 4, p. 88, 1824 ("Missouri"; type lost).

Haltica pluriligata LeConte, Proc. Acad. Nat. Sci. Philadelphia, vol. 4, p. 27, 1858 (Kansas and Texas; type in LeConte collection, Mus. Comp. Zool.).

Disonycha pluriligata LeConte, Smithsonian Contr. Knowl., vol. 11, p. 25, 1859.

Disonycha quinquevittata Horn, Trans. Amer. Ent. Soc., vol. 16, p. 203, 1889 (in part).—JACOBY, Biol. Centr. Amer., vol. 6, suppl., p. 276, 1891.—SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 279, 1931.

Description.—Elongate oblong oval, somewhat shining; pale, head with occiput, labrum, and often tubercles darker, pronotum usually 5-spotted, lateral spots sometimes evanescent, elytra with sutural,

median, and submarginal vittae, metasternum in part, apex of tibiae, and tarsi dark. Head with interocular space slightly more than half its width; tubercles distinctly marked, carina not acute, broad, and slightly produced; coarse punctures about fovea on each side of head near eye, but median space usually smooth; pale with labrum, usually tubercles, and occiput darker. Antennae robust, dark with paler basal joints, third joint shorter than fourth or fifth, which are subequal, the fourth longer. Prothorax not twice as wide as long, narrowed very little anteriorly with only slightly arcuate sides; not very convex; a slight callosity on either side on basal half and a median basal depression; surface alutaceous and finely punctate; pale with five spots, sometimes lateral spots and median stripe evanescent. Scutellum dark. Elytra with parallel sides, somewhat convex, humeri well developed and an intrahumeral sulcus; on lateral apical half a trace of the ridges characteristic of the *pensylvanica* group, and slightly more developed than in *alternata*; surface alutaceous and finely punctate; vittae usually wider than in *alternata* except in the southwestern specimens, and the sutural and submarginal often rather feebly joined at apex. Body beneath densely and somewhat coarsely pubescent, pale with metasternum in part, usually the middle, dark; apex of tibiae and tarsi dark. Length, 6.8 to 7.8 mm; width, 3.5 to 4.4 mm.

Type locality.—Kansas (as here restricted).

Distribution.—Tennessee; Illinois (Elizabethtown, East St. Louis, Grafton, Grand Tower, Kahokia, Metropolis, Peoria, Quincy); Kansas (Topeka); Missouri; Arkansas (Texarkana); Oklahoma (Cleveland County); Texas (Brownsville, Columbus, Dallas, Del Rio, Laredo, Wellborn); Louisiana (Baton Rouge, Mandeville); Colorado (Boulder).

Food plant.—*Salix*.

Remarks.—The specimen labeled *pluriligata* in the LeConte collection also bears a green label, indicating that it is probably the Kansas specimen mentioned in the original description. It fits the description and may be considered the type. In most collections *pluriligata* is confused with *alternata*. As LeConte states, *pluriligata* is "allied to *alternata*, but narrower and with a less transverse thorax." It is very difficult, however, to distinguish the two species in many instances, and the only certain means is to dissect for the aedeagus, that of *pluriligata* having a broad tip quite different from the acute tip of *alternata*. In general, *pluriligata* is more elongate, has a smoother head, the prothorax is narrower, the elytral vittae are wider, and the elytral ridging in the female is more pronounced. Its range, also, is more southern, no specimens being as yet known from Canada, New England, or the Northwestern States. I have seen

only one specimen east of Tennessee, and this is a specimen labeled College Park, Md., collected by Duckett (see notes under *alternata*); the accuracy of this label is open to considerable doubt.

DISONYCHA PLURILIGATA var. PURA (LeConte)

PLATE 2, FIGURE 10

Haltica pura LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 4, p. 86, 1858 (Colorado River, California; type in LeConte collection, Mus. Comp. Zool.).

Disonycha pura LECONTE, Smithsonian Contr. Knowl., vol. 11, p. 25, 1859.

Disonycha capitata JACOBY, Biol. Centr. Amer., vol. 6, pt. 1, p. 316, 1884. [No type locality designated, but these localities given: Mexico (North Sonora, Tuxtla, Cosamaloapam); Guatemala (Zapote Panzos).]

Disonycha quinquevittata var. *pura* HORN, Trans. Amer. Ent. Soc. vol. 16, p. 315, 1889.—? var. *pura* SCHAEFFER, Journ. New York Ent. Soc., vol. 27, p. 334, 1919.—var. *pura* SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 380, 1931.

Disonycha quinquevittata JACOBY, Biol. Centr. Amer., vol. 6, suppl., p. 276, 1891.

Description.—Usually smaller and paler than *pluriligata*, the pronotum not so heavily marked with spots, sometimes 4, but often only 2 anterior spots; the elytra with narrower vittae, and the submarginal one frequently very poorly defined; the body beneath sometimes entirely pale or with slight darkening in middle of metasternum. Length, 6.5 to 7.5 mm; width, 3.5 to 4 mm.

Type locality.—Colorado River, Calif.

Distribution.—Arizona (Globe, Nogales, Oak Creek Canyon, Phoenix, River Camp, Santa Cruz River, White Mountains, Yuma); New Mexico (Albuquerque); California (Calipatria, Colton, Colorado River, Imperial County, Needles, Pomona, Riverside, Yuma).

Food plant.—*Salix exigua* (D. K. Duncan).

Remarks.—The specimen labeled *pura* in the LeConte collection also bears a gilt label indicating that it was collected in California, and therefore may be considered the type. LeConte separated *pura* from *pluriligata* by its slenderer form and the uniform yellow color of the undersurface. These differences in general hold, but *pura* is only a pale, attenuated southwestern variety of *pluriligata*, as dissection reveals. The aedeagus is indistinguishable from that of the larger, more heavily marked Kansas and Texas specimens.

Jacoby dwelt upon the prominences of the thoracic tubercles in his description of *capitata*. In reality these callosities are not much more marked than in most of the *alternata* group, but the lack of coloring on the paler, arid country specimens accentuates these prominences. Jacoby states that it ranges as far south as Guatemala. Probably there is a confusion of more than one species in Jacoby's type series of *capitata*. The specimens from "North Sonora, Mexico" (=Arizona) collected by Morrison, some of which now in the

Museum of Comparative Zoology were purchased from Jacoby by Bowditch, are identical with LeConte's type of *pura*. I believe that these are some of the cotypes of *D. capitata* and designate "North Sonora" (i.e., Arizona) as the type locality.

10. DISONYCHA PUNCTIGERA LeConte

PLATE 3, FIGURE 11

? *Altica quinquevittata* SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 4, p. 88, 1824 ("Missouri"; type lost).

Disonycha punctigera LECONTE, Smithsonian Contr. Knowl., vol. 11, p. 24, 1859 (Kansas, near the Rocky Mountains; type in LeConte collection, Mus. Comp. Zool.).

Disonycha quinquevittata HORN, Trans. Amer. Ent. Soc., vol. 16, pp. 203, 315, 1889 (in part).

Disonycha neglecta SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 283, 1931 (Kansas; type in collection of Charles Schaeffer).

Disonycha punctipennis SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 284, 1931 (Lake Okoboji, Iowa; type, U.S.N.M. No. 44118).

Description.—Broadly oblong oval, feebly shining, elytra densely punctate; pale, occiput darkened, pronotum with 4 or 5 spots, elytral vittae narrow, metasternum, apex of tibiae, and tarsi dark. Head with interocular space more than half width of head; interantennal area broad, slightly produced, tubercles not swollen but distinctly marked; surface generally smooth and shining in middle with some punctures, coarse but not confluent, on each side about fovea near eye; posterior edge of occiput, usually tubercles, often a streak down carina, and labrum dark. Antennae dark with paler basal joints, third joint shorter than fourth or fifth, which are subequal, the fourth slightly longer. Prothorax scarcely twice as wide as long, convex without depressions, narrowed anteriorly with arcuate sides; surface alutaceous with fine punctation; pale, usually with four spots, the median stripe more or less obsolete or reduced to a spot. Scutellum dark. Elytra broadly oblong oval, convex, humeri marked by a short intrahumeral sulcus; surface alutaceous, distinctly and closely punctate; vittae narrow, submarginal and sutural not united at apex, usually submarginal not extending beyond median at apex. Body beneath finely pubescent; pale, with middle of metasternum and apex of tibiae and tarsi darkened. Length, 6.3 to 7.6 mm; width, 3.3 to 4.4 mm.

Type locality.—"Kansas near the Rocky Mountains."

Distribution.—Illinois (Fort Sheridan); Kansas (Onaga, Reno County, Riley County, Sylvia, Topeka); Nebraska (Lincoln); Iowa (Lake Okoboji); South Dakota (Madison); Montana (Billings); Colorado (Mancos, Platte Canyon); New Mexico (Aztec); Alberta (Edmonton).

Food plant.—Unknown.

Remarks.—In the LeConte collection are 3 specimens of this species, 1 of which is labeled *H. punctigera* and all of which bear the green circle label indicating that they are from the region given as the type locality. Following these three specimens are several others not of this species, but *arizonae*, and not fitting LeConte's description. In his description LeConte differentiated this species clearly from others closely resembling it. According to the original description, *punctigera* is broader proportionately than any of the *alternata* group, the prothorax is more convex, lacking the depressions such as are found in the *alternata* group, and the elytra are strongly and densely punctured. Moreover, the submarginal and sutural vittae, as he also states, are not at all joined, in this respect differing from *arizonae*. In short, *punctigera*, although at first glance resembling *alternata*, is not related to it. The head is smoother, the prothorax and elytra are differently shaped and lack depressions, and the aedeagus is unlike that of *alternata*, but resembles somewhat that of *D. caroliniana*, an oval species. Possibly this is the species described by Say as *A. quinquevittata* (see p. 65).

Mr. Schaeffer has sent me a paratype of *D. neglecta* from Kansas, which he has donated to the National Museum (no. 44116). It is a male and has been preserved for some time in alcohol and is therefore paler, but in no other way separable from typical specimens of *D. punctigera* LeConte. A type (male) and three paratypes (1 male and 2 females) of *D. punctipennis* in the United States National Museum are identical with typical specimens of *D. punctigera*. Apparently, although Mr. Schaeffer has recognized the species, he has never connected LeConte's name *punctigera* with it, but has considered *alternata* as *punctigera*. This is shown by species labeled *D. punctigera* by him in the National Museum, which are *alternata*, and by his most recent paper on *Disonycha* (1931).

11. DISONYCHA ARIZONAE Casey

PLATE 3, FIGURE 13

Disonycha arizonae CASEY, Contributions, pt. 1, p. 52, 1884 (Arizona; type U.S.N.M. No. 49225, Casey collection).—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 206, 1889.

Disonycha glabrata JACOBY, Biol. Centr. Amer., vol. 6, pt. 1, p. 311, 1884 (in part).

Disonycha davisi SCHAEFFER, Journ. New York Ent. Soc., vol. 32, p. 141, 1924 (Anglesea, N.J.; type, U.S.N.M. No. 42426).

Description.—Oblong, feebly shining, with moderately densely punctate prothorax and elytra; pale, usually with a small dark spot on occiput and dark labrum, tubercles sometimes dark, two anterior spots on prothorax, and sutural, median, and submarginal elytral vittae; apex of tibiae and tarsi dark. Head with interocular space

more than half width of head; frontal carina not acute, broad and somewhat produced, tubercles well marked but flat; middle of occiput and front usually smooth with some coarse punctures about fovea near eye; pale, with often a small spot in middle of occiput, the tubercles frequently brown and the labrum always dark. Antennae short, dark with paler basal joints, third, fourth, and fifth joints subequal, the fourth slightly the longest, the remainder nearly as broad as long. Prothorax a little over twice as wide as long; somewhat convex, a little narrowed anteriorly, with sides arcuate; surface more or less distinctly and quite densely punctate, alutaceous; pale with two anterior spots, not close together and somewhat oblique, with anterior ends approximate. Scutellum dark. Elytra broadly oblong oval, convex, with humeri not prominent and without intrahumeral sulcus; surface alutaceous, somewhat shining, densely and often coarsely punctate; sutural, median, and submarginal vittae only moderately wide, the submarginal uniting with sutural at apex. Body beneath usually finely and densely pubescent, but in Arizona specimens only sparsely pubescent; entirely pale, the apex of tibiae and tarsi brown, and sometimes the middle of the anterior femora with a brown marking. Length, 4.6 to 6.5 mm; width, 2.6 to 3.2 mm.

Type locality.—Arizona, collected by H. K. Morrison.

Distribution.—Maine (Monmouth, Paris, Wales); Massachusetts (Chicopee, Malden, Springfield); Connecticut (Meriden); Rhode Island (Providence); New York; New Jersey (Anglesea, Boonton, Troy Hill); Pennsylvania (Frankford); Maryland (Odenton); District of Columbia; Virginia (Falls Church); Tennessee (Elmwood); South Carolina (Clemson College); Illinois (Anna, Billets Station, Bloomington, Champaign, Normal, Urbana); Iowa (Iowa City); Missouri (Virgil City); Nebraska (Lincoln, Malcolm); Kansas (Douglas County, Garden City, Onaga, Riley County, Topeka); Texas (Alpine, Brownsville, Cypress Hills, Devils River, Sabinal, San Antonio, San Diego); Arizona (Baboquivari Mountains, Cochise County, Douglas, Fort Grant, Gila County, Huachuca Mountains, Nogales, Oak Creek Canyon, Palmerly, Pinal Mountains, Santa Cruz County, Santa Rita Mountains, Sierra Anche); New Mexico (Las Vegas); Manitoba (Aweme).

Food plants.—Potato, *Solanum tuberosum* (Blanchard); Russian-thistle, *Salsola pestifer* (in New Mexico).

Remarks.—The type series of this species consists of two specimens, both females, in the Casey collection, which correspond with Casey's precise description of *arizonae*. There is also a set in the National Museum collection labeled "Arizona, Morrison", which probably is from the same series. Still another specimen of the same series in the National Museum, mounted on a pin with a specimen of *glabrata*

with the locality label "N. Sonora, Mexico, Morrison", from the *Biologia material*, has been identified, presumably by Jacoby, as *glabrata*.

This species of *Disonycha* is one of the most widespread over the United States, being found in the east from Maine to Texas and westward to Arizona. It also occurs in Canada. It is distinguished by the oblong shape, the rather closely punctate pronotum and elytra, the two somewhat distant pronotal spots, the short, robust antennae, and pale undersurface. In size and punctuation it is somewhat variable. Casey's Arizona specimens differ from Schaeffer's eastern specimens (*davisi*) very little except in degree of coloration and elytral punctuation, the Arizona ones being paler and not so deeply punctate and therefore with smoother and more shining elytra. The undersurface of Casey's specimens is also less pubescent (the more sparsely punctate ventral surface is Schaeffer's chief distinction between *davisi* and *arizonae*). I can find no difference in the aedeagi in specimens from Massachusetts, Tennessee, Texas, and Arizona. As a rule, the northern specimens are larger, of darker coloring, and more heavily punctate. A series from Tennessee and some from Texas are small with the elytra densely but not deeply punctate. Another series from Batchawana Bay, Lake Superior, Ontario, comprising the largest of the specimens, is so coarsely punctate as to be confused with *punctigera*; in fact, this species is confused with *punctigera* in the series of the LeConte collection under *punctigera* (see notes under that species). It differs from *punctigera* in the shape of the aedeagus and in having the submarginal and sutural vittae united at the apex. This Lake Superior series is the most divergent of all the specimens examined and deserves a varietal name.

***DISONYCHA ARIZONAE BOREALIS*, new variety**

PLATE 3, FIGURE 14

Description.—Of same shape and coloring as *arizonae* but with much coarser and deeper pronotal and elytral punctuation; fourth antennal joint distinctly longer than third or fifth; aedeagus (see pl. 3, fig. 14) of same general shape as in *arizonae*, but with minor differences. Length, 5.5 to 6.8 mm; width, 3 to 3.5 mm.

Type.—Male and 7 paratypes (5 female, 2 male), U.S.N.M. No. 43650.

Type locality.—Batchawana Bay, Lake Superior, Ontario, collected by H. G. Hubbard and E. A. Schwarz.

Other locality.—Marquette, Mich.

The type series was listed by Hubbard and Schwarz (Proc. Amer. Philos. Soc., vol. 17, p. 640, 1878), from Bachewauung Bay (spelling recently changed on maps) and Marquette under the specific name *punctigera* as determined by LeConte.

12. *DISONYCHA TENUICORNIS* Horn

PLATE 3, FIGURE 12

Disonycha tenuicornis HORN, Trans. Amer. Ent. Soc., vol. 16, p. 208, 1889
(southern Arizona; type in Horn collection, Acad. Nat. Sci., Philadelphia).

Description.—Broadly oblong oval, moderately shining, pale with two anterior dark pronotal spots, and very narrow dark median elytral vitta and narrowly darkened sutural edges, the submarginal vitta usually being only faintly indicated; antennae unusually long and slender, extending fully half the length of the elytra in the female (longer in the male). Head with interocular space more than half width of head; interantennal area broad and flat, frontal tubercles scarcely marked, occiput and front smooth and shining, only a few scattered punctures on either side about fovea near eye; head entirely pale. Antennae dark with paler basal joints; long and slender, extending fully half length of elytra, third joint a little shorter than fourth and fifth, which are subequal, the fourth slightly longer, sixth and seventh nearly as long. Prothorax not twice as broad as long, nearly rectangular with sides only slightly arcuate, somewhat convex; shining, almost impunctate; pale with two anterior dark spots. Scutellum dark brown. Elytra somewhat convex, oblong, with humeri not prominent and with little trace of an intrahumeral sulcus; moderately shining, under high magnification finely alutaceous and finely punctate; pale with unusually narrow median vitta, sutural vitta usually consisting of scarcely more than darkened sutural edges, submarginal vitta poorly defined, more distinct and wider at apex and uniting with sutural vitta. Body beneath densely covered with fine pubescence, entirely pale, legs pale with a darkened streak on outside of femora, tarsi brown. Claws with basal tooth much longer than in other species of the genus. Length, 6 to 7.6 mm; width, 3 to 4.5 mm.

Type locality.—Southern Arizona; type collected by H. K. Morrison.

Distribution.—New Mexico (Alamogordo, Organ Mountains); Arizona (Chiricahua Mountains, Cochise County).

Food plant.—Unknown.

Remarks.—*Disonycha tenuicornis*, a species so far found only in New Mexico and Arizona, is unusual in having long and very slender antennae. It is broadly oblong with a broad head, and the elytra have very narrow vittae. In the specimens examined, the male is considerably smaller than the female. I have seen only a few specimens, and since the species is apparently rare, these deserve particular mention. I have examined three specimens in Horn's collection, 2 from Alamogordo, N. Mex., and 1 from Arizona; 1 in

the collection of Ralph Hopping from Cochise County, Ariz.; and 2 in the National Museum, from the Organ Mountains, N. Mex., and Chiricabua Mountains, Ariz.

13. DISONYCHA CAROLINIANA (Fabricius)

PLATE 3, FIGURE 16

Crioceris caroliniana FABRICIUS, Systema entomologiae, p. 122, 1775 (Carolina; Drury collection; type apparently lost).

Chrysomela caroliniana FABRICIUS, Mantissa insectorum, vol. 1, p. 75, 1787.

Galleruca caroliniana FABRICIUS, Entomologia systematica, pt. 2, p. 24, 1792; Systema Eleutheratorum, vol. 1, p. 491, 1801.

?*Cistela vittata* FABRICIUS, Entomologia systematica, pt. 2, p. 47, 1792.

?*Cistela vittata* FABRICIUS, Systema Eleutheratorum, vol. 1, p. 491, 1801.

?*Altica caroliniana* OLIVIER, Encyclopédie méthodique, vol. 4 (vol. 1, Insects), p. 105, 1789; Entomologie, vol. 6, p. 684, 1808.

?*Haltica caroliniana* ILLIGER, Mag. für Insekt., vol. 6, p. 144, 1807.

Disonycha caroliniana CHEVROLAT, Dejean Catalogue, p. 414, 1837.—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 315, 1889.

Disonycha quinquevittata FABRICIUS, in Gemminger and Harold, Catalogus coleopterorum, p. 3497, 1876.

Disonycha pulchra CASEY, Contributions, pt. 1, p. 51, 1884 (Chester, Pa.; U.S.N.M. No. 49224, Casey collection).

Disonycha alternata HORN, Trans. Amer. Ent. Soc., vol. 16, p. 315, 1889 (as synonym; not *H. alternata* Illiger).

Description.—Oblong oval, smooth, somewhat shining; pale with darker antennae, two pronotal spots, placed near anterior margin, dark sutural, median, and submarginal elytral vittae and dark tibiae and tarsi. Head with interocular space considerably more than half width of head; interantennal area scarcely carinate, broad; tubercles not swollen; surface smooth except for a few punctures on each side about fovea; entirely pale. Antennae dark with basal joints a little paler, third, fourth, and fifth joints subequal, the fourth slightly the longest. Prothorax fully twice as broad as long, narrowed anteriorly with arcuate sides; convex; surface shining, very indistinctly punctate; pale with two spots placed near anterior margin, these spots occasionally large and in one specimen coalescing. Scutellum broadly triangular, dark. Elytra oblong oval, sides rounded, humeri not pronounced or marked by intrahumeral sulcus; surface somewhat shining, under high magnification minutely alutaceous and finely and indistinctly punctate; sutural and submarginal vittae narrow and usually not quite uniting at apex, median vittae only moderately wide. Body beneath finely but not conspicuously pubescent; entirely pale except the darkened tibiae and tarsi, frequently only apex of tibiae dark. Length, 5.8 to 6.5 mm.; width, 3.2 to 3.8 mm.

Type locality.—"Carolina."

Distribution.—Massachusetts (Chicopee, Cambridge, Framingham, Lynn Beach, Springfield); New York; Connecticut (Lyme); Pennsylvania (Chester); Maryland (Bladensburg, Glen Echo); Virginia (Camp Humphreys, Virginia Beach); North Carolina; Georgia (Thomasville); Florida (Capron, Enterprise, Haulover, Jacksonville, Miami, Sanford); Louisiana (Covington); Texas (College Station); Oklahoma (Osage County); Illinois (Meredosia).

Food plant.—Unknown. (Fabricius, 1801, gave the food plant as *Amaranthus spinosus*, but confusion between this species and *glabrata* may have occurred at that time.)

Remarks.—The type of Fabricius' species, described from the Drury collection, seems to have been lost. K. G. Blair, of the British Museum, has lent me for examination a specimen determined as *caroliniana*, "the determination of which is probably more or less traditional", that agrees with specimens compared by Dr. W. G. Kuntzen, of the Berlin University Zoological Museum. Doctor Kuntzen writes that in the Berlin Museum are six specimens under the name *caroliniana* received from Fabricius himself, all of which agree with the meager description of *caroliniana*. Illiger, as Doctor Kuntzen writes, with little doubt described a different species under the name *caroliniana*. Probably Olivier also had a different species or confused two species under *caroliniana*. According to Olivier's description the pronotum is sometimes immaculate and sometimes has two spots, and in his illustration the pronotum is without markings. No specimen of *caroliniana* that I have examined is without the anterior pronotal spots. It is possible that Olivier had before him the smaller, oval species described by Blatchley as *admirabilis*. The illustration fits that species, and in many collections *admirabilis* is labeled *caroliniana*, mainly, I believe, on account of Olivier's illustration.

D. caroliniana, which is rather poorly represented in most collections, appears to inhabit the coastal region from Massachusetts to Texas. I have seen one specimen from Oklahoma and one from Illinois. It is very much like the pale form of *fumata*, described by Schaeffer as *lodingi*, but can be distinguished from that by its shorter and subequal third, fourth, and fifth antennal joints, and its entirely pale head, as well as by its shorter and broader prothorax. It is larger than *admirabilis*, and always has two anterior pronotal spots, which are not usually present in *admirabilis*. The eastern variety of *latifrons*, described by Schaeffer as *laticollis*, is usually larger and darker, the labrum and frequently the metasternum being dark. The aedeagus of *caroliniana* is not like that of any other North American species of *Disonycha*.

D. pulchra was described by Casey from two fresh specimens of this species, both females, collected near Chester, Pa. The live

beetles are much brighter in coloring. Casey's beetles now have the usual appearance of dried museum specimens of this species.

14. DISONYCHA FIGURATA Jacoby

PLATE 3, FIGURE 15

Disonycha figurata JACOBY, Biol. Centr. Amer., vol. 6, pt. 1, p. 314, 1884 (type not designated; Mexico to Panama).

Description.—Broadly oval, feebly shining, pale yellow; prothorax with 2, rarely 4 dark spots anteriorly; elytra with usually indistinct sutural, median, and submarginal vittae, occasionally these vittae dark brown and well marked. Head with interocular space more than half width of head; interantennal area broad, scarcely carinate, a group of punctures about fovea on each side near eye; head smooth, shining and entirely pale except for the brown labrum and occasionally slightly darkened frontal tubercles. Antennae piceous, fourth joint longer than third or fifth. Prothorax less than twice as broad as long, convex, narrowed anteriorly with slightly arcuate sides; shining, indistinctly and sparsely punctate; pale with 2 anterior dark spots, occasionally, in darker specimens, with 4 spots and a trace of a median line. Scutellum brownish. Elytra oval, somewhat convex, with humeri not prominent; surface shallowly, closely, and rather indistinctly punctate; pale yellow with usually indistinct and narrow sutural, median, and submarginal vittae, the submarginal and sutural vittae tending to unite at apex; in darker specimens the vittae sometimes stronger and brownish. Body beneath pale with middle of metasternum and occasionally middle of abdomen dark, a streak, sometimes a darkened area, on femora, and the apex of tibiae and tarsi dark. Length, 6.2 to 7 mm; width, 3.2 to 3.5 mm.

Type locality.—Not designated; the following localities given: Mexico (Ventanas, Cerro de Plumas, Oaxaca, Juquila, Cordova, Playa Vicente, Tuxtla, Capulalpam, Guanajuato); Guatemala (Capitillo, Duenas, Chacoj); Panama (Bugaba).

Distribution.—Nevada (Hot Springs); Arizona (Nogales, Patagonia, Santa Rita Mountains). Mexico to Panama.

Food plant.—Unknown.

Remarks.—This species, described by Jacoby from Mexico, Guatemala, and Panama, has been collected in the United States in Nevada and Arizona. It is remarkable on account of its pale and ill-defined elytral vittae, often so indistinct that the elytra appear entirely pale yellow-brown. Occasionally, in a darker specimen, the vittae are distinct enough to make the species easily confused with *latifrons* or even *fumata*, but the paler undersurface and the shape of the aedeagus distinguish these darker forms. It is quite distinct from any other North American species, in spite of Jacoby's statement

that he had "not much doubt that the insect is but a pale or maybe immature form of *D. alternata* or an allied species."

I am indebted to Dr. E. C. Van Dyke for the opportunity to examine a series of specimens taken by E. P. Van Duzee at Patagonia, Ariz., a small station on the southeast slope of the Santa Rita Mountains, on August 2, 1924, two of which Dr. Van Dyke has donated to the collection of the National Museum. The species was described from 13 localities between Ventanas, Mexico (Durango?) and Bugaba, Panama, and no type locality is designated. This is the first record of its occurrence in the United States.

Mr. Schaeffer has sent me two unidentified specimens of this species from his collection from Nogales, Ariz., and Hot Springs, Nev. In the latter specimen the elytral vittae are fully as dark as in other vittae species. Two paratypes are in the National Museum from Capetillo, Guatemala, collected by G. C. Champion.

15. DISONYCHA FUMATA (LeConte)

PLATE 4, FIGURE 17

Haltica fumata LeConte, Proc. Acad. Nat. Sci. Philadelphia, vol. 4, p. 86, 1858 (Texas and New Mexico; type in LeConte collection, Mus. Comp. Zool.).

Disonycha alternata var. *fumata* Gemminger and Harold, Catalogus coleopterorum, p. 3496, 1876.

Disonycha crenicollis Horn, Trans. Amer. Ent. Soc., vol. 16, p. 204, 1889.—Jacoby, Biol. Centr. Amer., vol. 6, pt. 1, p. 316, 1884 (in part). (Not *Altica crenicollis* Say.)

Disonycha alternata Jacoby, Biol. Centr. Amer., vol. 6, pt. 1, p. 311, 1884 (in part).

Disonycha horni Jacoby, Biol. Centr. Amer., vol. 6, suppl., p. 275, 1891 (in part) (Puebla, Mexico; type in British Museum).

Disonycha fumata Schaeffer, Journ. New York Ent. Soc., vol. 27, p. 334, 1919.

Description.—Oblong oval, feebly shining, smooth; pale, the labrum, sometimes the frontal tubercles, and the occiput dark; the pronotum always with 2 and often with 5 spots, the elytra with the usual sutural, median, and submarginal vittae, the metasternum usually dark, and in darker specimens apex of femora, the tibiae, and the tarsi dark; antennae long and slender, fully one half length of beetle in male. Head with interocular space half width of head; frontal carina somewhat produced, but not acutely; tubercles not swollen but well marked; surface smooth with coarse punctures on each side about fovea near eye, often bearing hairs; labrum long and always dark, tubercles and occiput frequently dark. Antennae unusually long, dark with paler basal joints, fourth joint nearly twice as long as third; fourth, fifth, sixth, and seventh subequal, the fourth slightly the longest. Prothorax barely twice as broad as long, often less, convex, a slight depression in middle near basal margin; anteriorly with arcuate sides; somewhat shining, under high magnification minutely alutaceous, very indis-

tinctly punctate; pale with the 2 anterior spots the most heavily marked and closely placed, sometimes uniting with each other and the median line; the 2 lateral spots if present paler and large. Scutellum dark. Elytra oblong, convex, humeri well marked, with short intra-humeral sulcus; surface somewhat shining, under high magnification alutaceous, very indistinctly punctate; vittae only moderately wide, the submarginal and sutural usually narrowly united. Body beneath covered with dense pale pubescence; pale, the mesosternum and metasternum dark except in some of the Arizona specimens (*quinquerutata*); in the pale eastern form (*Iodongi*) the undersurface often entirely pale; femora in darker specimens with a dark apex, tibiae and tarsi dark. Length, 5.5 to 7 mm; width, 2.8 to 3.8 mm.

Type locality.—Texas (as here restricted).

Distribution.—New York (?); Texas (Anahuac, Brownsville, Cotulla, Del Rio, Sarita, Victoria); Missouri.

Food plant.—*Aster*.

Remarks.—The specimen in the LeConte collection bearing the label *fumata*, which may be regarded as the type, is from Texas, as indicated by the dark red circle label, and is a dark specimen with the frontal tubercles dark, the pronotal spots well marked, the median ones forming a triangle, the mesosternum and metasternum dark and the abdomen and femora brownish. Four others, mounted two to a pin on the long broad points characteristic of Morrison's collection, bear Arizona labels. These are somewhat paler, with the pronotal spots not so close together, and represent var. *quinquerutata* (Schaeffer) described on page 39.

D. fumata is one of the oval species and is readily distinguished from both *caroliniana* and *latifrons* by its longer antennae, its narrower interocular space, its long, dark labrum, and longer, narrower prothorax. It occurs in the southern part of the United States from Alabama and Texas to California, and is also found in Mexico. There is a large series of it not separable by the aedeagus or any other structural character in the National Museum collection with the locality label "N.Y. collection of J. B. Smith", but this label may be incorrect.

There has been considerable confusion concerning the name for this species. Although Horn synonymized *fumata* with *quinquevittata*, from his description and from specimens labeled *crenicollis* in the Horn collection it is evident that he considered *fumata* as the same as *crenicollis*. Mr. Schaeffer (1919) has come to the same conclusion, and has pointed out that *crenicollis* was described by Say from Mexico. Say's description of the indented black pronotal lateral "dot", as well as the black venter, does not fit either *fumata* or *latifrons*, the two species most commonly found labeled *crenicollis*

in collections. I have been unable to identify *D. crenicollis* (Say) in any material examined.

Jacoby confused several species with *fumata*, which he listed in the *Biologia* as a variety of *alternata*, following the Gemminger and Harold Catalogue. But specimens of *fumata* from his collection in the Bowditch collection from North Sonora, Mexico (Morrison) have been labeled *crenicollis*. Later, in the Supplement to the *Biologia*, Jacoby decided that specimens he had previously referred to *crenicollis* represented a new species, to which he gave the name *horni*.

D. horni, in turn, represents another confusion of species. According to K. G. Blair, the specimen bearing the label *D. horni* in the British Museum is from Teapa, which is in the lowlands of south-eastern Mexico. Some of the same original set of specimens from Teapa in the National Museum and also in the Bowditch collection (from Jacoby) are also labeled *D. horni*. Mr. Blair states, on the other hand, that the specimen of *horni* figured in the *Biologia* is from Mexico (Puebla) in the Sallé collection, and is "smaller and shorter", and "to my mind agrees with *fumata* Lec." (as determined by writer) and that "Jacoby's description of *horni* agrees as regards the tibiae rather with the specimen figured than with that to which the label is attached."

Under *horni*, as well as under *crenicollis* in his earlier treatment, Jacoby gives as one of his localities "N. Sonora, Mexico (Morrison)." Specimens in the National Museum taken by Morrison in this locality (which is known now to be Arizona and not Mexico), are identical with *fumata* LeConte and probably represent the same series as that from which LeConte drew up his description, in part. Therefore, it seems best to regard as the type of *D. horni* the specimen figured in the Sallé collection and thus to dispose of the name *horni* as a synonym of *D. fumata* LeConte, and to describe the species from Teapa, Mexico, as new.²⁴

²⁴ *DISONYCHA TEAPENSIS*, new species

PLATE 8, FIGURE 44

Disonycha horni JACOBY, Biol. Centr. Amer., vol. 6, suppl., p. 295, 1891 (in part).

Description.—Elongate oblong (7.5 mm), not shining, yellow, pronotum uneven and with two anterior dark spots; elytra with traces of costae in female, and with dark sutural, median, and submarginal vittae; undersurface with middle of metasternum and area about coxae dark. Head with interocular space about half width of head, smooth in middle with punctures on either side near eye; tubercles distinct, interantennal area somewhat produced but not acutely so; pale with narrow occipital band, somewhat darkened tubercles, and dark labrum. Antennae extending about to middle of elytra, dark with paler basal joints, fourth joint nearly twice as long as third. Prothorax not twice as wide as long, with arcuate sides; disk uneven with lateral callosities; surface alutaceous, indistinctly punctate; pale, with two well-marked anterior dark spots. Scutellum dark. Elytra oblong with parallel sides, humeri pronounced, with a short, deep intra-humeral sulcus; in female traces of costae in apical half of elytra; surface alutaceous,

Mr. Schaeffer has described as *D. quinquerutata* the paler, smaller, southwestern variety that corresponds with the Arizona specimens of *fumata* in the LeConte collection. He has also described as *D. lodingi* a paler form that occurs in Alabama. Neither the small, southwestern arid country form nor the larger Alabama form is separable by any structural differences from the Texas specimens. The aedeagi of all three are indistinguishable. I have, however, retained Mr. Schaeffer's names as varietal names for these color forms. The food plant in the West is *Aster spinosus* as recorded by H. R. Brisley,²⁵ and H. P. Loding has collected it in Alabama on a species of wild aster.

DISONYCHA FUMATA var. QUINQUERUTATA Schaeffer

PLATE 4, FIGURE 19

Disonycha quinquerutata SCHAEFFER, Journ. New York Ent. Soc., vol. 27, p. 336, 1919 (Bill Williams Fork, Ariz.; type, U.S.N.M. No. 42419).

Disonycha carolina BRISLEY, Trans. Amer. Ent. Soc., vol. 51, p. 175, 1925.

Description.—Smaller and paler than typical specimens of *fumata*, with pronotal spots not so closely placed and undersurface paler. Length, 5.7 mm.

Type and one paratype in the United States National Museum.

Type locality.—Bill Williams Fork, Ariz.

Distribution.—Arizona (Bill Williams Fork, Clemenceau, Douglas, Florence, Fort Yuma); New Mexico (Albuquerque); southwestern Utah; California (El Centro, Meloland).

DISONYCHA FUMATA var. LODINGI Schaeffer

PLATE 4, FIGURE 18

Disonycha lodingi SCHAEFFER, Journ. New York Ent. Soc., vol. 27, p. 337, 1919 (Delchamps, Ala.; type, U.S.N.M. No. 42421).

indistinctly punctate; sutural, median, and submarginal dark vittae not so wide as pale intervening vittae, the submarginal and sutural vittae sometimes uniting at apex. Body beneath finely pubescent, pale, the middle of metasternum, area about coxae, and most of the tibiae and tarsi dark. Length, 7.5 to 7.8 mm; width, 4 mm.

Type male and three paratypes, U.S.N.M. No. 43651.

Type locality.—Teapa, Tabasco, Mexico, collected in March by H. H. Smith.

Distribution.—Known only from the type locality.

Remarks.—This species is labeled *D. horni* by Jacoby in the Biologia material in the National Museum, in the Museum of Comparative Zoology, and in the British Museum, and these specimens seem to be paratypes of *D. horni* Jacoby. The typification of Jacoby's name has been discussed above.

D. teapensis belongs to the *alternata* group, having a similar uneven pronotum and traces of elytral costae in the female. It most closely resembles *D. pluriligata* var. *pura*, a Sonoran form. *D. teapensis*, on the other hand, comes from the lowlands of south-eastern Mexico. It is slenderer than *pluriligata*, the head is smoother, and the aedeagus has a broadly pointed tip, which is broader than in any of the other species in that group possessing an acute tip.

²⁵ Brisley, Trans. Amer. Ent. Soc., vol. 51, p. 175, 1925. The specimens on which this record was based, listed by Brisley as "*carolina*", have been examined by the writer and found to be *D. fumata*.

Description.—Paler than typical specimens of *fumata*, the pronotum with only two spots anteriorly, undersurface pale. Easily distinguished from *D. caroliniana* by the dark labrum, and longer antennae. Length, 6 mm.

Type and four paratypes in United States National Museum.

Type locality.—Delchamps, Ala.

Distribution.—Alabama (Delchamps, Baldwin County).

16. *DISONYCHA LATIFRONS* Schaeffer

PLATE 4, FIGURE 20

Disonycha latifrons SCHAEFFER, JOURN. New York Ent. Soc., vol. 27, p. 336, 1919 (Fort Defiance, Ariz.; type, U.S.N.M. No. 42420).

Description.—Broadly oblong oval, smooth, feebly shining; pale, head with labrum always and occiput behind eyes usually dark, pronotum with 2 roundish spots, often wider than long and usually small and not close together, but in darker specimens all 5 pronotal spots present and the anterior ones sometimes coalescing; elytra with narrow sutural and submarginal vittae united at apex, median vitta wider; body beneath sometimes entirely pale (in eastern variety), but usually with mesosternum except in middle, metasternum, and abdomen, except the last segments, dark; tibiae and tarsi dark. Head with interocular space considerably more than half width of head; interantennal area broad, flat, not produced; frontal tubercles very faintly marked, sometimes not at all defined but continuous with front; smooth, shining, with a group of punctures on each side about fovea; pale, with labrum always dark and occiput behind eyes usually dark. Antennae short, dark, with paler basal joints, third joint considerably shorter than fourth. Prothorax fully twice as wide as long, convex, with only slight median basal depression; somewhat narrowed anteriorly with arcuate sides; surface minutely alutaceous and finely punctate; pale with 2 roundish spots anteriorly, not close together, in darker forms 5 spots present, the anterior ones sometimes coalescing. Scutellum broadly triangular, dark. Elytra broadly oblong, convex; humeri not prominent, with only a trace of intrahumeral sulcus; surface moderately shining, under high magnification finely alutaceous, finely and moderately densely but shallowly punctate; sutural and submarginal vittae narrow and distinctly united at apex; median vitta narrow except in dark forms. Body beneath finely but not conspicuously pubescent; varying greatly in extent of dark coloring; in eastern forms undersurface often nearly pale, with only darker shading on metasternum, in typical western form the mesosternum and metasternum, and usually the abdomen except last ventral segments, entirely dark. Femora always pale, tibiae and tarsi dark. Length, 5.2 to 7.8 mm; width, 2.9 to 4 mm.

Type locality.—Fort Defiance, Ariz. (type female and one paratype in National Museum).

Distribution.—Arizona (Fort Defiance); New Mexico (Albuquerque, Kohler Junction, Torrance County); Nevada (Lincoln County, White Pine County); Utah (Juab County); Colorado (Buttes, Denver, Fort Collins, Golden, Pawnee, Pingree Park); Wyoming (Medicine Bow, Paint Creek, Yellowstone National Park); Montana (Assiniboine, Bozeman, Butte, Crazy Mountains, Dillon, Gallatin Mountains, Musselshell); California (Macdoel); South Dakota (Black Hills, Elmore).

Remarks.—Typical *latifrons* from Arizona, as described by Schaeffer, is pale with a dark labrum and a dark occiput behind the eyes, the pronotum has only 2 transverse spots, the elytral vittae are narrow, and the ventral surface is black except the prosternum, middle of mesosternum, and last 2 ventral segments, which are pale. This color form is common throughout the Rocky Mountains from Arizona to Montana.

DISONYCHA LATIFRONS var. ASTERIS Schaeffer

PLATE 4, FIGURE 21

Disonycha asteris SCHAEFFER, Journ. New York Ent. Soc., vol. 32, p. 141, 1924 (Stonewall, Manitoba; type, U.S.N.M. No. 42427).

Disonycha latifrons var. *asteris* SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 281, 1931.

Description.—Of same size and sculpture as typical *latifrons*, but darker in markings, frontal tubercles marked by a dark line (but this line not any more depressed than in many specimens of typical *latifrons*; prothorax with five large spots, sometimes the two anterior coalescing; elytral vittae wider than in paler form.

Type locality.—Stonewall, Manitoba; collected by J. B. Wallis. Type, U.S.N.M. No. 42427, and three paratypes in National Museum.

Distribution.—British Columbia (Rolla, Swift Current); Alberta (Edmonton, Banff, Ledue, Pincher Creek); Saskatchewan (Moose Jaw); Manitoba (Aweme); Quebec.

Food plant.—Collected on white aster in a swamp (Wallis).

DISONYCHA LATIFRONS var. LATICOLLIS Schaeffer

PLATE 4, FIGURE 22

Disonycha laticollis SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 284, 1931 (Wyandanch, N.Y.; type in collection of Charles Schaeffer).

Disonycha quinquevittata WHITEHEAD, Nova Scotia Ent. Soc. Proc., 1918, p. 38. (Not *Altica quinquevittata* Say.)

Slightly larger than typical western specimens of *latifrons*, and paler, the pronotum usually with only two well-marked small an-

terior spots, and the elytra with narrow vittae. The undersurface sometimes entirely pale or with only the metasternum dark. Length, 7 to 8.2 mm.

Type locality.—Wyandanch, N.Y. (one paratype, U.S.N.M. No. 44117).

Distribution.—Wisconsin (Cranmoor); Minnesota (Mora); Illinois (Chicago); Michigan (Lake Douglas); New York (Wyandanch); New Jersey; Maine (Casco Bay); New Hampshire; Massachusetts (Chicopee, Springfield); Nova Scotia (Truro).

Remarks.—Mr. Schaeffer has sent me a paratype of *laticollis* from Wyandanch, N.Y., which he has donated to the National Museum, and two other specimens from Casco Bay, Maine, both of which belong to the same species.

D. latifrons, like *D. arizonae* and *D. fumata*, has a wide range, and varies in size and degree of coloration in different localities. The Rocky Mountain specimens usually have a more or less darkened undersurface. The Canadian specimens have larger pronotal spots, and the eastern specimens are larger and paler. No sharp line can be drawn between these various races, since their geographic distribution is continuous from Arizona to British Columbia in the Rocky Mountains, and eastward through the provinces of Canada and through the Northern States to Nova Scotia, Maine, and New Jersey. The aedeagus of specimens from Montana does not differ except in size from that of specimens from Massachusetts.

Var. *asteris* was collected by J. B. Wallis on white aster in Alberta. In Nova Scotia W. E. Whitehead²⁶ reared the eastern variety, *laticollis*, from *Solidago squarrosa*, and in Massachusetts George Dimmock collected it on *S. altissima*. Like *D. fumata*, it is evidently a feeder on Compositae.

Like *fumata* and *caroliniana*, *latifrons* is oval and has a distinctly convex prothorax. The western and Canadian varieties are easily distinguished from *fumata* by the dark undersurface. The eastern paler variety has been confused in collections with *caroliniana*. *D. caroliniana* nearly always has a pale labrum, while that of *latifrons* is always dark. Moreover, *latifrons* is generally larger and broader proportionately. The head is unusually smooth and unbroken by swelling of the frontal tubercles or carina. *D. fumata* has a much narrower head with the frontal tubercles and interantennal convexity well marked. The aedeagus of *latifrons* somewhat resembles that of *fumata*, but has a broader tip, and is quite different from the aedeagus of *caroliniana*.

²⁶ Whitehead, Nova Scotia Ent. Soc. Proc., 1918, p. 38. I have examined specimens from which this record was made and found them to be *D. latifrons* var. *laticollis*.

17. DISONYCHA DISCOIDEA (Fabricius)

PLATE 5, FIGURE 23

Galleruca discoidea FABRICIUS, Entomologia systematica, vol. 1, pt. 2, p. 25, 1792 (North America; type lost?).

Chrysomela discoidea FABRICIUS, Systema Eleutheratorum, vol. 1, p. 445, 1801.

Halitica discoidea ILLIGER, Mag. für Insekt., vol. 6, p. 143, 1807.

Disonycha discoidea MELSHEIMER, Catalogue, p. 122, 1853.—CROUCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873.—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 208, 1889.

Disonycha nigridorsis STURM, Catalogue; in Gemminger and Harold, Catalogue coleopterorum, p. 3497, 1876 (as synonym). (Amer. bor.)

Description.—Large (7 mm), broadly oblong oval, feebly shining; pale with large discoidal black spot, somewhat variable in size, but never attaining margin of elytra; tibiae with a darker outer streak, tarsi black; in variety *abbreviata* a dark sutural and a median vitta instead of discoidal spot. Head with interocular space over half width of head; carina broadly rounded, a little produced; frontal tubercles merely indicated; surface smooth and shining, nearly impunctate, with a single large fovea on each side near eye; entirely pale. Antennae short, robust, dark, the basal joints and sometimes the apical ones paler; third joint a little shorter than fourth or fifth, which are subequal. Prothorax about twice as wide as long, somewhat convex, without depressions, narrowed slightly anteriorly with feebly arcuate sides; surface finely alutaceous and finely punctate, entirely pale. Scutellum pale or dark. Elytra broadly oblong oval, somewhat convex; humeri not prominent, with only faint trace of intrahumeral sulcus; surface alutaceous, moderately closely and distinctly punctate; discoidal spot variable in size, always more than half the elytra, never covering margin, usually tapering to apex but not quite reaching it. Body beneath finely pubescent, entirely pale, tibiae with a darker outer edge. tarsi dark. Length, 6.5 to 7.8 mm; width, 3.8 to 4.5 mm.

Type locality.—North America.

Distribution.—Maryland (Plummers Island, Great Falls, Marshall Hall); District of Columbia; Virginia (Nelson County); South Carolina (Charleston); Georgia (Atlanta); Kentucky (Louisville); Tennessee (Knoxville, Blount County); Alabama (Langdale, Chambers County, Sheffield); Louisiana (Baton Rouge); Texas (Dallas, Colorado County); Arkansas (Prairie County); Kansas (Douglas County).

Food plant.—*Passiflora lutea* Linnaeus (H. S. Barber).

Remarks.—This is the only species of *Disonycha* in the United States with a black discoidal spot, evidently formed by the coalescence of vittae, a common phenomenon in some other genera of Chry-

somelidae, such as *Trirhabda*. A closely related species with similar discoidal marking, *D. marginipennis* Suffrian, occurs in the West Indies, and in Mexico are two species, *D. subaenea* Jacoby and *D. sallaei* Jacoby, resembling *discoidea* in color pattern. All three are easily separable by other characters. *D. dorsata* Jacoby, also from Mexico and Central America, in its paler form has a discoidal spot, but it is not at all closely related to *discoidea*, but rather to *glabrata*.

DISONYCHA DISCOIDEA var. ABBREVIATA Melsheimer

PLATE 5, FIGURE 24

Disonycha abbreviata MELSHEIMER Proc. Acad. Nat. Sci. Philadelphia, vol. 3, p. 163, 1847 (Pennsylvania; type in Melsheimer collection, Mus. Comp. Zool.).—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 207, 1889.

Disonycha abbrevita (sic) CROTCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873.

Disonycha discoidea var. *abbreviata* SCHAEFFER, Journ. New York Ent. Soc., vol. 27, p. 33, 1919.

Description.—Of same size, sculpture, and coloring as *discoidea*, but with a sutural and a median vitta on each elytron instead of a black, discoidal spot, these vittae not reaching apex.

Type locality.—Pennsylvania.

Distribution.—District of Columbia; Maryland (Cabin John, Plummers Island); Virginia (Nelson County, Falls Church); Kentucky ("near Cincinnati, Ohio"); Kansas (Topeka); Illinois (Bloomington); Indiana (Edwardsville).

Remarks.—Schaeffer, having examined specimens showing an intergradation in color, has suggested that *abbreviata* and *discoidea* may be color varieties of the same species, and this suspicion apparently is confirmed by examination of the aedeagi, which are indistinguishable. I have not seen any specimens showing an intergradation in color.

18. DISONYCHA LEPTOLINEATA Blatchley

PLATE 5, FIGURES 25, 26

Disonycha abbreviata var. *leptolineata* BLATCHLEY, Can. Ent., vol. 40, p. 143, 1917 (Dunedin, Fla.; cotype, U.S.N.M. No. 21514).

Description.—Oblong oval, somewhat shining, smooth; pale with dark sutural and median elytral vittae, the sutural one extending nearly to the apex; metasternum in dark specimens usually more or less darkened, undersurface in typical *leptolineata* entirely pale; outside edge of tibiae and tarsi dark. Head with interocular space more than half width of head, carina broadly rounded and somewhat produced, frontal tubercles not prominent; surface smooth, shining, often impunctate or nearly so, with a single large fovea on each side near eye; entirely pale, tip of mandibles sometimes darkened. Anten-

nae short, dark, basal joints paler, third joint a little shorter than fourth or fifth, which are subequal, the fourth slightly longer. Prothorax not twice as broad as long, somewhat convex, narrowed anteriorly with slightly arcuate sides; finely alutaceous and minutely punctate, entirely pale. Scutellum pale or dark. Elytra oblong oval, a little convex, humeri not prominent and only slight trace of intrahumeral sulcus; surface alutaceous, finely punctate, a sutural and a median vitta on each elytron, the sutural one almost reaching apex, in Florida specimens the vittae very narrow. Body beneath finely pubescent, sometimes entirely pale, often with metasternum in part or whole darkened; outer edge of tibiae usually dark, and tarsi dark. Length, 6.2 to 7.5 mm; width, 3.4 to 4.5 mm.

Type locality.—Near Dunedin, Fla.

Distribution.—Florida (Dunedin, Biscayne, Capron, Fort Myers, Lake Ashby, Lake Worth, Orange County).

Food plant.—Unknown.

Remarks.—The species belonging to the *discoidea* group are very closely related structurally, although there is considerable variation in size and coloring. *D. leptolineata* was described by Blatchley from pale specimens from Florida in which the vittae are extremely narrow. Schaeffer described *texana* from Texas from small, dark specimens. Both Schaeffer and Blatchley distinguished their species from *abbreviata* by color and finer punctation. Aside from the difference in degree of dark coloring, *texana* is not readily separable from *leptolineata*, and in this paper is treated as a color variety.

DISONYCHA LEPTOLINEATA var. TEXANA Schaeffer

PLATE 5, FIGURE 27

Disonycha texana SCHAEFFER, JOURN. New York Ent. Soc., vol. 27, p. 339, 1919 (Brownsville, Tex.; type, U.S.N.M. No. 42422).

Description.—Elytra with median and sutural vittae wider than in typical *leptolineata*. Aedeagus with lower lip slightly broader and less acutely narrowed. Length, 6 to 7.5 mm; width, 3.5 to 4.5 mm.

Type locality.—Brownsville, Tex.; type and one paratype in National Museum.

Distribution.—Virginia (Norfolk, Lake Drummond); North Carolina (Washington); South Carolina (Swansea); Louisiana (Tallulah); Texas (Alice, Beeville, Brownsville, Calvert, College Station, Corpus Christi, Cotulla, Dallas, Denton, Handley, Lexington, Mesquite, Mission, Plano, Rosser, Sinton, Wolfe City, Victoria); Kansas (Douglas County); Arizona (Cochise County); Mexico.

This variety is not confined to Texas but extends southward into Mexico and westward to Arizona. There are also specimens from Virginia that are larger and with more pronounced punctation, but not so distinct as in *discoidea*.

Several characters seem to indicate that *leptolineata* is specifically distinct from *discoidea*: (1) The punctation is never so heavy as in *discoidea*; (2) the aedeagus has a little more slender tip; and (3) no form of *leptolineata* is yet known in which the elytral vittae coalesce to form a discoidal spot.

19. *DISONYCHA ANTENNATA* Jacoby

PLATE 5, FIGURE 28

Disonycha antennata JACOBY, Biol. Centr. Amer., vol. 6, pt. 1, p. 35, 1884 (Mexico; type not designated).

Disonycha albida BLATCHLEY, Can. Ent., vol. 56, p. 169, 1924 (Big Pine Key, Fla.; type in collection of W. T. Davis).

Description.—Broadly oblong oval, smooth, somewhat shining, entirely pale except for dark antennae, dark streak on outside of tibiae, and dark tarsi. Head with interocular space more than half width of head; carina broadly rounded, slightly produced, tubercles not prominent, smooth and shining, usually impunctate or nearly so with a large fovea on each side near eye; pale, except sometimes a darkened tip to mandibles. Antennae short, robust, dark with paler basal joints, third point shorter than fourth or fifth, which are subequal with the fourth slightly longer. Prothorax about twice as wide as long, somewhat convex, narrowed a little anteriorly with slightly arcuate sides; finely alutaceous, very indistinctly punctate, entirely pale. Scutellum pale. Elytra broadly oblong oval, somewhat convex, humeri not prominent, with a short intrahumeral sulcus; surface somewhat shining, under high magnification finely alutaceous, very finely punctate, entirely pale. Body beneath sparsely and inconspicuously pubescent, entirely pale; tibiae with a dark outer streak, or only apex darkened, tarsi dark. Length, 6.5 to 7.6 mm; width, 3.6 to 4.2 mm.

Type locality.—Type not designated but the following localities given: Mexico (Ventanas, Cordova, Vera Cruz, Panistlahuaca, Jalapa).

Distribution.—Florida (Big Pine Key); Mexico.

Food plant.—Unknown.

Remarks.—Only two specimens of this pale species taken in the United States are known to me, one, the type of *D. albida*, in the collection of W. T. Davis, and the other in the National Museum, taken by H. S. Barber, both collected on Big Pine Key. It is a Mexican species which may have taken foothold at the tip of Flor-

ida on Big Pine Key, but which cannot yet be very abundant there. It belongs to the *discoidea* group, being very closely related structurally. The aedeagus is very much like that of *discoidea* and *leptolineata*. No other species of *Disonycha* in the United States is so pale as this. *D. figurata*, another pale Mexican species that has crept into the United States only in Arizona and Nevada, has two dark pronotal spots and indistinct elytral vittae.

20. DISONYCHA ALABAMAE Schaeffer

PLATE 6, FIGURE 29

Disonycha alabamae SCHAEFFER, JOURN. New York Ent. Soc., vol. 27, p. 337, 1919 (Citronella, Ala.; type in collection of Charles Schaeffer).

Description.—Small (5 mm), oblong oval, feebly shining, pale with dark labrum, tibiae, tarsi, and elytral vittae; the wide median vitta on each elytron considerably nearer to the submarginal vitta than to the sutural. Head with interocular space more than half width of head; tubercles somewhat swollen, carina broadly rounded and slightly produced; occiput smooth in middle with punctures on each side and the usual fovea near eye; pale with dark labrum. Antennae dark with paler basal joints, third, fourth, and fifth joints subequal, the fourth slightly the longest. Prothorax over twice as broad as long, somewhat convex, narrowed anteriorly with sides arcuate; not shining, distinctly alutaceous, with fine, rather dense punctation; entirely pale. Scutellum black, more rounded than in *admirabilis*. Elytra oval, not very convex, with humeri not at all prominent; surface alutaceous, finely and shallowly but distinctly punctate; sutural and submarginal vittae not united, the median one wide and placed closer to the submarginal vitta than to the sutural, the intervening pale space between it and the submarginal vitta being very narrow. Body beneath indistinctly and rather sparsely pubescent; entirely pale, the apex of tibiae and tarsi dark. Length, 5 mm; width, 2.5 mm.

Type locality.—Citronella, Ala., collected by H. P. Loding.

Distribution.—Alabama (Citronella); Texas (Columbus).

Food plant.—Unknown.

Remarks.—Although I have not dissected a male of this species, I am convinced that it is distinct from both *admirabilis* and *arizonae*, the two species that it resembles most closely. It differs from *admirabilis* in having antennal joints 3, 4, and 5 subequal (in *admirabilis* the third joint is decidedly shorter than the fourth), in having the prothorax more distinctly alutaceous and punctate, and in having the undersurface sparsely and indistinctly pubescent. It is distinguished from *arizonae* by its more oval shape, by having longer antennae, and by having the frontal tubercles more pronounced. It

differs from both in the more lateral position of the median vitta, which is its most striking characteristic.

I have seen only two specimens of this species, one, a male, from the collection of H. P. Loding, and the other, a specimen identified by Schaeffer in the LeConte collection from Columbus, Tex., probably collected by E. A. Schwarz.

21. *DISONYCHA ADMIRABILIS* Blatchley

PLATE 6, FIGURE 30

Disonycha admirabilis BLATCHLEY, Journ. New York Ent. Soc., vol. 32, p. 90, 1924 (Knox County, Ind.; type in collection of W. S. Blatchley).

Description.—Small (about 5 mm), oval, somewhat shining, pale; pronotum usually unspotted, sometimes with two anterior spots, elytra with sutural, median, and submarginal vittae, the sutural and submarginal rarely joining at apex; undersurface pale with tibiae and tarsi darker. Head with interocular space more than half width of head; carina not acute, broad and slightly produced, tubercles somewhat swollen, occiput smooth and shining; punctures about fovea on each side near eye; pale, with tubercles sometimes and labrum always dark. Antennae dark with paler basal joints, third joint distinctly shorter than fourth or fifth, which are subequal. Prothorax approximately twice as wide as long, convex, narrowed somewhat anteriorly with arcuate sides; under high magnification very finely alutaceous and indistinctly, sparsely punctate; shining, pale, usually without spots, sometimes with 2 anterior ones, rarely 4. Scutellum dark. Elytra oval, somewhat convex, humeri not prominent, with a short intrahumeral sulcus; finely alutaceous, finely and shallowly punctate; pale, with sutural, median, and submarginal vittae, the submarginal and sutural vittae rarely united at apex. Body beneath finely and densely pubescent, entirely pale; tibiae and tarsi brownish. Length, 4.8 to 5.8 mm; width, 2.6 to 3.2 mm.

Type locality.—Knox County, Ind.; type, male, collected by W. S. Blatchley, and in his collection.

Distribution.—Massachusetts (Chicopee); New York (Long Island, West Point); New Jersey (Dundee Lake); District of Columbia; Maryland (Cabin John, Chesapeake Bay, Plum Point, Glen Echo); Virginia (Clarendon, Virginia Beach); Louisiana (Baton Rouge, Covington, Opelousas, Tallulah); Texas (College Station, Columbus, Cypress Mills, Edna, Gainesville, Galveston, Lexington, San Diego, Victoria); Kansas (Douglas County).

Food plants.—*Cassia* sp. (J. D. Mitchell); wild legume (Norman Allen); *Polygonum* sp. (W. S. Blatchley).

Remarks.—This is one of the smallest of the pale vittate species, and is characterized by its oval shape, shining, very indistinctly

punctate surface, and pale coloring. The pronotal spots are usually entirely lacking. It is possibly the species illustrated in Olivier's *Entomologie* under *caroliniana*, and is therefore confused in some collections with *caroliniana*, a somewhat larger species.

Mr. Blatchley has kindly sent me the type of this species for examination. His specimen has preserved the fresh coloring of the live beetle very well, and the red and silvery colors of the elytra are still apparent, although in the majority of the dried specimens this coloring has faded to uniform pale yellow or brownish yellow. In his description the head is said to be impunctate, and this is true for his specimen except for the fovea, which consists of a circle of coarse punctures united to form a depression on each side of the head near the eye. Other specimens, however, frequently have scattered punctures on each side of the head, and the frontal tubercles are often darker brown than the rest of the head.

22. DISONYCHA GLABRATA (Fabricius)

PLATE 6, FIGURE 32

Crioceris tomentosa FABRICIUS, *Systema entomologiae*, p. 122, 1775 (not *Chrysomela tomentosa* Linnaeus, 1758).

Crioceris glabrata FABRICIUS, *Species insectorum*, vol. 1, p. 156, 1781 (In Africa aequinoctiali).

Chrysomela glabrata FABRICIUS, *Mantissa insectorum*, vol. 1, p. 76, 1787.

Altica vittata OLIVIER, *Encyclopédie méthodique*, vol. 4 (vol. 1, Insects), p. 105, 1789.

Galleruca glabrata FABRICIUS, *Entomologia systematica*, vol. 1, pt. 2, p. 25, 1792; *Syst. Eleuth.*, vol. 1, p. 494, 1801.

Altica glabrata OLIVIER, *Entomologie*, vol. 6, p. 685, 1808.

Altica alternata LATREILLE, in *Voy. Humboldt, Zool.*, vol. 2, p. 39, 1833 (not *Haltica alternata* Illiger).

Disonycha glabrata CHEVROLAT, in *Dejean Catalogue*, p. 414, 1837.—CROUCH, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 25, p. 64, 1873.—HAROLD, *Coleopterologische Hefte*, vol. 15, p. 4, 1876.—JACOBY, *Biol. Centr. Amer.*, vol. 6, pt. 1, p. 311, 1884.—HORN, *Trans. Amer. Ent. Soc.*, vol. 16, p. 207, 1889.

Disonycha horticola CHEVROLAT, in *Dejean Catalogue*, p. 414, 1837 (Mexico).

Disonycha albicollis STURM, *Catalogue*, p. 283, 1843 (Amer. hor.).

Description.—Elongate oblong oval, polished, pale yellow with darkened occiput, median pronotal spot, this sometimes lacking or occasionally three pronotal spots, and broad black sutural, median, and marginal elytral vittae; undersurface pale, sometimes darkened in middle of metasternum and abdomen. Head with interocular space about half width of head; smooth with a few punctures about fovea on each side near eye; frontal tubercles well marked, carina narrowly produced; pale with occiput and sometimes tubercles and labrum dark. Antennae dark with pale basal joints, third joint much shorter than fourth and fifth, which are subequal, the fourth the longer. Prothorax approximately twice as broad as long, con-

vex, somewhat narrowed anteriorly, with arcuate sides, shining, very faintly punctate, pale with a median dark diamond-shaped spot, sometimes two smaller lateral spots, or occasionally immaculate. Scutellum black. Elytra convex with the humeri marked by a short intrahumeral sulcus; sides parallel; surface shining, shallowly punctate, in some specimens (from Arizona and Texas) punctation very indistinct; pale with broad sutural, median, and usually marginal vittae (in Arizona specimens the margin is not darkened and there is only a narrow submarginal vitta); sutural and marginal vittae uniting at apex. Body beneath finely pubescent, variably colored, sometimes entirely pale with only apex of tibiae and tarsi dark, sometimes the metasternum, middle of abdomen, apex of femora, the tibiae, and the tarsi dark; epipleura, except in pale Arizona specimens, dark. Length, 5.3 to 6.3 mm; width, 3 to 3.5 mm.

Type locality.—"In Africa *aequinoctiali*" (see discussion later).

Distribution.—New York; Pennsylvania (Allegheny); Maryland (Bladensburg, Cabin John, College Park, Plummers Island); District of Columbia; Virginia (Falls Church, Fredericksburg, Nelson County, Norfolk); North Carolina (Southern Pines); South Carolina (Dalzell); Georgia (Thomasville); Florida (Dade City, Enterprise); Alabama (Mobile); Louisiana (Baton Rouge, Delchamps, Tallulah); Kentucky (Wickliffe); Tennessee (Elmwood); Texas (Brownsville, Columbus, Cypress Mills, Dallas, Gainesville, Greenville, Handley, Harlingen, Mineola, New Braunfels, Plano, Rosser, Santa Maria, Waco); Missouri; Illinois (Alto Paso, Billets Station, Dubois, Elizabethtown, Fountain Bluff, Herod, Metropolis, Prairie du Rocher, Pulaski, Urbana); Indiana (Vermillion County); Ohio; Colorado; Arizona (Cochise County, Douglas, Gila Valley, Globe, Graham County, Huachuca Mountains, Nogales, Oracle, Palmerly, Santa Rita Mountains, Tucson); New Mexico (Las Vegas); West Indies, Mexico, Central America to South America.

Food plants.—"Habitat in Jamaica Myrto Pimenta. Dr. Schwarz" (Fabricius, 1801); *Amaranthus retroflexus* Linnaeus (Garman, Chittenden); oak, bull thistle (Blatchley).

Remarks.—Fabricius (1775) originally applied the Linnaean name *tomentosa* to a species that he described in contradiction to Linnaeus' "elytris subtomentosis" as having the "elytra in rostro glabra, nitida." He gave the locality in this first description as "America." In 1781, repeating his shorter diagnostic description of this species, he gave it the name *glabrata* and quoted the Linnaean description of *tomentosa* with a question. The locality this time was given as "in Africa aequinoctiali" (not, as Harold stated, "America aequinoctiali"). In 1787, Fabricius again published the same short description of *glabrata*, without mentioning Linnaeus'

tomentosa and without locality. In 1792 the original long description under the name *glabrata* was repeated, with the locality this time given as Jamaica, and in his treatment of *glabrata* in 1801 Fabricius again gave the locality as Jamaica. From the original description (1775) it is plain that Fabricius had before him something quite different from Linnaeus' *Chrysomela tomentosa*, which is probably some species of *Galerucella*.²⁷ The original description of *glabrata* applies in every way to the *Disonycha* to which the name *glabrata* is now given.

This species is widely distributed. It is found throughout Mexico, Central America, and into South America, and in the West Indies. In the United States it occurs as far north as New York and Illinois and west to Arizona. The Arizonan and sometimes the Mexican specimens are paler. In them there is only a spot on the occiput, the pronotum is sometimes immaculate, the usually distinctive black marginal vitta does not cover the margin, the other vittae are often narrower, and the undersurface and epipleura are pale. The elytral punctation of the southern specimens is also not as deep. Otherwise, in its wide range, the species presents little variation. *D. glabrata* is not closely related to any other North American species but is allied to two Mexican and Central American species, *D. dorsata* Jacoby and *D. nigrita* Jacoby.²⁸

One of the specimens of the Biologia material in the National Museum labeled *glabrata* is *D. arizonae* Casey, indicating that Jacoby may have confused that species with *glabrata* in his treatment of *Disonycha* of Mexico and Central America.

23. DISONYCHA MARITIMA Mannerheim

PLATE 6, FIGURE 31

Disonycha maritima MANNERHEIM, Bull. Soc. Imp. Moscou, vol. 16, p. 311, 1843 (California).—CROTCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873.—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 206, 1889.

Description.—Small (4 to 5 mm), broadly oblong oval, somewhat shining, densely punctate, pale with dark labrum and occipital spot extending down front, and sutural, median, and marginal vittae covering most of the elytra; undersurface dark except prosternum and last ventral segments. Head with interocular space a little over half width of head; frontal carina narrow, slightly produced; occiput and front as far as tubercles usually densely and coarsely punctate, sometimes with a smooth median area; pale with black occipital spot extending down front and a darkened labrum. Antennae dark

²⁷ Blake, Revision of the species of beetles of the genus *Trirhabda* north of Mexico. Proc. U.S.Nat.Mus., vol. 79, art. 2, p. 13, 1931.

²⁸ Blake, Bull. Brooklyn Ent. Soc., vol. 26, p. 76, 1931.

with paler basal joint, third, fourth, and fifth joints subequal, the fourth slightly the longest. Prothorax approximately twice as wide as long, somewhat convex, narrowed anteriorly with arcuate sides; alutaceous, densely and moderately coarsely punctate, except sometimes a smooth median linear area; entirely pale. Scutellum dark. Elytra broadly oblong oval, convex, humeri not marked and with little trace of intrahumeral sulcus, moderately coarsely and densely punctate and somewhat shining; pale with wide sutural, median, and marginal vittae, the sutural and marginal vittae uniting at apex. Body beneath sparsely and indistinctly pubescent, shining black except prosternum and last ventral segment; legs black with a light streak on outside of tibiae. Length, 4 to 5 mm; width, 2.3 to 3.3 mm.

Type locality.—California, near shore. Collected by Eschscholtz and Blaschke.

Distribution.—California (Birds Landing, Carmel, Colton, Figueroa Park, Los Angeles, San Mateo, San Francisco, Warners, Yosemite National Park); Nevada (Ormsby County).

Food plant.—Sugar beet (*Beta vulgaris* var.).

Remarks.—*D. maritima*, like *glabrata*, has a dark marginal vitta on the elytra, but differs from *glabrata* in being coarsely and densely punctate and in having dark legs and a darker ventral surface. Like *glabrata*, it is not closely related to any other North American species, and appears more closely allied to the species with dark elytra than to the vittate species.

Dr. E. C. Van Dyke²⁹ has noted that this insect sometimes hibernates in colonies. He collected it in the clefts of rocks along the crest of San Bruno Hills, on the southern boundary of San Francisco County. I have collected it in July at an altitude of 8,000 feet at Glacier Point, Yosemite National Park.

24. DISONYCHA COLLATA (Fabricius)

PLATE 7, FIGURE 41

Crioceris collata FABRICIUS, Systema Eleutheratorum, vol. 1, p. 463, 1801 (Carolina; Bosc collection).

Altica collata OLIVIER, Entomologie, vol. 6, p. 702, 1808.

Disonycha collata DEJEAN, Catalogue, p. 414, 1837.—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 212, 1889 (in part).

?*Disonycha collaris* CROTCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873.

Disonycha mellicollis HORN, Trans. Amer. Ent. Soc., vol. 16, p. 211, 1889 (not *Altica mellicollis* Say).

Description.—Elliptic oval, with shining metallic green or blue elytra, dark upper half of head, and partially darkened undersurface; lower front of head, prothorax, femora, and margin of abdomen

²⁹ Van Dyle, Ent. News, vol. 30, p. 244, 1919.

pale. Head with interocular space scarcely half width of head; interantennal area carinate but not much produced, tubercles indistinctly marked, a few coarse punctures scattered about fovea on each side near eye, often in a row, producing a furrow between the eye and frontal tubercles, but leaving middle of front and occiput smooth; antennal sockets and lower front about carina pale, labrum dark, usually the tubercles and always the area about eyes and upper part of head dark with a metallic luster. Antennae dark brown, the three basal joints paler, third, fourth, and fifth joints subequal, the fourth slightly the longest. Prothorax approximately twice as wide as long, nearly rectangular with sides slightly bowed, somewhat convex, without depressions, minutely alutaceous and very indistinctly punctured, entirely pale. Scutellum black. Elytra shining lustrous green or blue, somewhat convex, with humeri only faintly marked, smooth, minutely alutaceous, and finely, not closely punctate. Body beneath with fine, pale pubescence, femora and margin of abdomen pale, mesosternum and metasternum and middle of abdomen dark brown, often with a metallic luster, tibiae and tarsi more or less darkened. Length, 4 to 5.5 mm; width, 2.2 to 3 mm.

Type locality.—"Carolina." Collected by Bosc.

Distribution.—Maine (Portland); Massachusetts (Lynn); Rhode Island (Providence); New York (Fort Hamilton, Long Island); New Jersey (Clementon); Pennsylvania (Philadelphia); Maryland (Bladensburg); District of Columbia; North Carolina (Southern Pines); Florida (Boynton, Capron, Jacksonville, Jupiter, Miami, Point Garda, St. Lucie, Sand Point, North Smyrna); Alabama (Mobile); Mississippi (Gulfport); Louisiana (Bonfouca, Merryville, New Orleans, Tallulah); Texas (Alice, Brownsville, College Station, Corpus Christi, Columbia, Cypress Mills, Corsicana, Dallas, Harlingen, Kerrville, Kingsville, Mercedes, Pierce, Rosson, Wichita Falls, Victoria); Arkansas; Kansas (Douglas County, Onaga, Topeka); Missouri (St. Louis); Ohio (Columbus); Indiana (Turkey Run); Illinois (Anna, Dubois, Centralia, Havana, Prairie du Rocher, Pulaski, Quincy, St. Joseph, Urbana); Mexico and Central America.

Food plants.—*Portulaca*, *Amaranthus*, spinach, beet, chickweed, lettuce.

Remarks.—Although the original Fabrician description of *collata* is short, the essential color characters, the bicolored head, the pale prothorax, pale femora and margin to the abdomen, and smooth, shining green elytra sufficiently differentiate it from other closely allied species. It is found most frequently in collections under the name *D. mellicollis* (Say). Horn attempted to distinguish *collata* and *mellicollis* by size and punctation. Say's description of *melli-*

collis does not fit any species of *Disonycha* known to me either from North America or Central America. It differs from *collata* in that the head is "blue black" with "immaculate face," and the venter is blackish with the last segment dull yellow. It differs from *triangularis*, *xanthomelas*, and *politula* in that the "thighs are honey-yellow."

Disonycha collata is somewhat variable in both size and punctuation. The Florida and Kansas specimens are usually much smaller and green, and with very fine punctuation, while the Texas and northern specimens are larger, bluish in color, and with distinct punctuation. There is no difference in the aedeagi, however. The species ranges from Portland, Maine, west to Kansas and Missouri, and south into Mexico and Central America.

25. *DISONYCHA SEMICARBONATA* LeConte

PLATE 6, FIGURE 33

Disonycha semicarbonata LECONTE, Smithsonian Contr. Knowl., vol. 11, p. 25, 1859 (Santa Fe, N.Mex.; type in LeConte collection, Mus. Comp. Zool.).

Disonycha mellicollis HORN, Trans. Amer. Ent. Soc., vol. 16, p. 210, 1889 (in part).

Description.—Oblong oval, feebly shining, black; front, prothorax, last ventral segment, and femora pale. Head with interocular space slightly more than half width of head; frontal carina narrowly produced; punctuation coarse and rather dense over occiput and down front to tubercles; head dark except for frontal tubercles and about base of antennae and upper portion of carina. Antennae dark with paler basal joints, third, fourth, and fifth joints subequal, the fourth slightly the longest. Prothorax about twice as wide as long, almost rectangular with sides nearly straight, somewhat convex; alutaceous and finely, rather densely punctate, entirely pale. Scutellum dark. Elytra oblong oval, convex, with humeri not marked and with little trace of intrahumeral sulcus; distinctly alutaceous, closely and moderately coarsely punctate; entirely black and not very shining. Body beneath finely pubescent, dark, the prosternum, last ventral segment, and femora pale. Length, 5 mm; width, 2.8 mm.

Type locality.—Santa Fe, N.Mex.; one specimen (female) collected by Fendler.

Distribution.—New Mexico (Santa Fe, Magdalena Mountains); Colorado (Boulder).

Food plant.—Unknown.

Remarks.—Although this species has been synonymized with *mellicollis* (see discussion under *collata* on p. 53) by Horn, it is quite different, having a bicolored head and distinctly punctate pronotum. It differs from *collata* in that while the femora are pale

the ventral surface except the last segment is dark. It is also much more coarsely punctate than *collata*, both on the head, pronotum, and elytra, and, as LeConte remarked, it is broader and less oval than *collata* or *xanthomelas*. *D. collata* apparently does not occur west of the Great Plains, and specimens of *semicarbonata* have been examined only from Colorado and New Mexico. It differs from *xanthomelas* and *triangularis* in having a bicolored head, and from *politula* not only in its coloring but also in its punctation. The aedeagus is unlike that of any of the dark colored species.

This is another species that is rare in collections. I have seen only the LeConte type, a specimen in the Snow collection from Magdalena Mountains, N.Mex., and one in the Casey collection from Boulder, Colo.

26. DISONYCHA XANTHOMELAS (Dalman)

PLATE 7, FIGURE 38

Haltica collaris ILLIGER, Mag. für Insekt., vol. 6, p. 126, 1807 (not *Galleruca collaris* Fabricius, 1798).

Haltica xanthomelas DALMAN, Analecta entomologica, p. 79, 1823 (New York).

Disonycha xanthomelacna GEMMINGER and HAROLD, Catalogus coleopterorum, p. 3497, 1876.—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 209, 1889.

Disonycha meridivora MELSHEIMER, Catalogue, p. 122, 1853.—GEMMINGER and HAROLD, Catalogus coleopterorum, p. 3497, 1876 (Pennsylvania) (as synonym).

Description.—Elongate oval, feebly shining, the head, elytra, mesosternum and metasternum, and legs, except at base, black, the elytra often with aeneous or bluish luster; the prothorax, abdomen in part, and base of legs pale. Head with interocular space about half width of head; carina narrowly produced; a furrow of punctures on each side of head extending from fovea near eye down to antennal socket, leaving occiput and front usually smooth and impunctate, sometimes a few coarse, scattered punctures across front, head entirely dark and polished. Antennae dark with basal joints somewhat paler, third joint shorter than fourth or fifth, which are subequal, the fourth slightly longer. Prothorax approximately twice as wide as long, somewhat convex, without depressions, nearly rectangular with sides slightly arcuate; surface minutely alutaceous and very finely punctate, entirely pale. Scutellum black. Elytra black, feebly shining, with aeneous or bluish luster; oblong, convex, humeral prominences not marked; surface distinctly alutaceous, punctation fine, not dense. Body beneath pale with black shining mesosternum, metasternum, and legs; the trochanters, base of femora, and often posterior angle of metasternum more or less pale; abdomen pale, sometimes brown in middle; pubescence fine but indistinct. Length, 4.5 to 5.8 mm; width, 2.2 to 3.4 mm.

Type locality.—New York.

Distribution.—Northwest Territories; Quebec (St. Johns); Saskatchewan (Oxbow); Alberta (Blackfalds); Manitoba (Aweme); Massachusetts (Cambridge, Fall River, Fitchburg, Framingham, Nantucket, Sherborn, Springfield); Connecticut (Hartford); New York (Long Island, Potsdam); Pennsylvania (Germantown, Harrisburg, Philadelphia); Maryland (Plummers Island); District of Columbia; Virginia (Jonesville, Nelson County); Louisiana (New Orleans); Texas (Columbus, Cypress Mills, Dallas, Greenville, Mesquite, Plano, Victoria); Kansas (Cherokee, Douglas County, Kansas City, Lawrence, Topeka, Riley County); Nebraska (Malcolm); Iowa (Iowa City, Lake Okoboji, Muscatine, Solon); Wisconsin (Beaver Dam, Madison); Indiana (Franklin, Knox); Michigan (Detroit); Illinois (Algonquin, Bloomington, Centralia, Chicago, Dongola, Grand Tower, Homer, La Grange, Mahomet, Muncie, Oakwood, Peoria, Quincy, Riverside, St. Joseph, Springfield, Thompson Lake, Urbana); Ohio (Columbus).

Food plants.—Chickweed (*Stellaria media*), *Chenopodium album*, *Amaranthus spinosus*, spinach, beet (Chittenden).

Remarks.—This species, a well-known garden insect, is distinguished from *D. triangularis*, found on similar food plants, by its lack of pronotal spots and paler abdomen. Both species have dark heads and legs, but in *xanthomelas* the base of the femora is pale, and often the posterior femora have a pattern similar to that of *politula*, in which the pale basal half is diagonally marked off from the apical dark half. Some specimens from Canada are much smaller, but no structural differences are apparent and the aedeagi are like those of the larger ones.

DISONYCHA XANTHOMELAS var. CERVICALIS LeConte

Disonycha cervicalis LeConte, Smithsonian Contr. Knowl., vol. 11, p. 25, 1859 (Kansas and Georgia; type in LeConte collection, Mus. Comp. Zool.).

Description.—Head shining, dark brown (not black), a furrow of punctures as in typical *xanthomelas* on each side of front, and a few scattered punctures across front; antennae with third, fourth, and fifth joints subequal, basal joints and last apical one paler. Prothorax as in *xanthomelas*. Elytra oblong oval with humeri not marked and with only a slight trace of intrahumeral sulcus; sculpture and coloring similar to typical *xanthomelas*. Body beneath entirely pale; legs except at base dark, the posterior femora with a paler streak on the inside.

Type locality.—Kansas (as here restricted).

Distribution.—Kansas; Georgia.

Remarks.—There is only one specimen of this in the LeConte collection, a female bearing a green label, indicating that it is the Kansas specimen mentioned by LeConte. The other specimen re-

ferred to by LeConte is evidently one in Horn's collection labeled "Ga.", and is the only other specimen I have examined. I have not dissected any specimen of *cervicalis*, but cannot distinguish it from specimens of *xanthomelas* except by the paler coloring of the undersurface. There is considerable variation in size and coloring of the undersurface in the latter species.

DISONYCHA XANTHOMELAS ATRELLA, new variety

PLATE 7, FIGURE 39

Description.—Small (4 mm), entirely dark except the prothorax and last 1 or 2 ventral segments. Head shining black, frontal tubercles often not at all marked and continuous with the carina; carina narrowly produced; a furrow of punctures extending from fovea on each side near eye toward antennal socket, sometimes scattered coarse punctures across front, head otherwise polished and dark. Prothorax as in typical *xanthomelas*. Elytra oblong oval, shining black without aeneous luster, the punctation usually finer than in typical *xanthomelas*. Body beneath finely and indistinctly pubescent, entirely dark except prosternum and last ventral segment and margin of penultimate segment, sometimes base of legs slightly paler. Length, 4.2 to 4.8 mm; width, 2.2 to 2.8 mm.

Type male and 4 paratypes (1 female, three male). The type and two paratypes in Museum of Comparative Zoology, Cambridge, Mass., Blanchard collection. Two paratypes (male), U.S.N.M. No. 43652.

Type locality.—Tyngsboro, Mass., collected by F. Blanchard.

Distribution.—Massachusetts (Tyngsboro); Virginia (Fort Monroe, Hubbard and Schwarz collection); Alabama (Mount Vernon, H. P. Loding collector).

Remarks.—At first glance this small dark variety of *xanthomelas* appears like a distinct species. The head in some specimens has the frontal tubercles undivided by any line or depression from the carina, giving it a most unusual appearance. The aedeagus, however, so closely resembles that of *xanthomelas* that it is doubtful whether it can be more than varietally distinct.

27. DISONYCHA TRIANGULARIS (Say)

PLATE 7, FIGURE 36

Altica triangularis SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 4, pt. 1, p. 84, 1824 (Missouri; type lost).

Haltica puncticollis KIRBY, Fauna Boreali Amer., vol. 4, p. 218, 1837 (Canada, "Lat. 65°").

Disonycha triangularis MELSHEIMER, Catalogue, p. 122, 1853.—CROUCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873.—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 209, 1889.

Description.—Broadly oblong oval; head, elytra, mesosternum, metasternum, abdomen, and legs black, feebly shining, elytra sometimes with bluish, purplish, or aeneous luster; prothorax pale with three triangularly placed median black spots. Head with interocular space considerably more than half width of head; carina narrowly produced; occiput and front except polished tubercles distinctly and usually closely punctate; entirely shining black. Antennae dark with somewhat paler basal joints, third joint shorter than fourth or fifth, which are subequal, the fourth slightly longer. Prothorax over twice as wide as long, somewhat convex, narrowed anteriorly with sides nearly straight, distinctly alutaceous, not shining, finely punctate; pale with three small median black spots—two roundish ones anteriorly and a more elongate median one. Scutellum black. Elytra slightly convex, broadly oblong oval, with humeri not prominent and with only a trace of intrahumeral sulcus; surface alutaceous, closely and distinctly punctate, feebly shining with bluish, purplish, or aeneous luster. Body beneath with mesosternum, metasternum, abdomen, and legs shining black, indistinctly and lightly pubescent. Length, 5.2 to 6.5 mm; width, 2.8 to 3.8 mm.

Type locality.—Missouri.

Distribution.—Vermont; Massachusetts (Chicopee, Fall River, Framingham, Lynn, Springfield); Rhode Island (Watch Hill); New York (New Windsor, Staten Island, West Point); New Jersey (Boonton, Clifton); Maryland (Bladensburg, Glen Echo); District of Columbia; Virginia (Nelson County); Kentucky; Texas (Ardmore, Cypress Mills, Llano, Texline, Wolfe City); Kansas (Clark County, Douglas County, Ellis County, Garden City, Gove County, Horace, Meade County, Riley County, Oakley, Salina, Topeka, Wichita); Iowa (Iowa City, Lake Okoboji, Moscow, Muscatine, Silver Lake, Solon); Missouri (Greene County, Willard); Oklahoma (Payne County); Wisconsin (Beaver Dam, Dane County, Madison, Sturgeon Bay, Waupaca); Michigan (Ann Arbor, Belding, Niles); North Dakota (University); South Dakota (Black Hills, Brookings, Elmore, Volga, Watertown); Minnesota (Fergus Falls); Indiana (Knox); Illinois (Algonquin, Champaign, Chicago, Elizabethtown, Forest City, Dubois, Havana, Quincy, Prairie du Rocher, Rockford, Thompson Lake, Urbana); Washington (Pullman); Idaho (Coeur d'Alene); Montana (Assiniboine, Bozeman, Gallatin, Helena); Colorado (Colorado Springs, Denver, Fort Collins, Logan County, Manzanola, Olney, Rocky Ford, Sterling); Utah (Ogden, Silver Lake); Wyoming (Chugwater); New Mexico (Torrance County, Beulah, Santa Fe County, Sandia Mountains); British Columbia (Aspen Grove, Chilcotin, Merritt, Midday Valley, Rolla); Alberta (Edmonton, Medicine Hat); Manitoba (Aweme, St. Norbert); Saskatchewan (Oxbow, Redvers).

Food plants.—Beet, spinach, *Amaranthus*.

Remarks.—*D. triangularis*, a well-known enemy of sugar beets and the largest of the dark-colored North American species, is readily recognizable by the short, broad prothorax with its three black spots arranged triangularly, the distinctly punctate elytra, and the dark head and undersurface.

DISONYCHA TRIANGULARIS MONTANENSIS, new variety

PLATE 7, FIGURE 37

Description.—Similar to *D. triangularis* in color and markings; prothorax not so broad, with more rounded sides, elytra more finely and sparsely punctate; aedeagus larger and somewhat differently shaped. Length, 5 mm; width, 2.5 mm.

Type (male).—U.S.N.M. No. 43653.

Type locality.—Assiniboine, Mont., collected by H. G. Hubbard and E. A. Schwarz.

Remarks.—Described from a single specimen. It is possible that this is specifically distinct from *D. triangularis*, although closely related, since the shape of the prothorax and the sculpture of the elytra are somewhat different, and the aedeagus, while of the general shape of that of *triangularis*, differs in several details.

28. DISONYCHA POLITULA Horn

PLATE 7, FIGURE 40

Disonycha politula HORN, Trans. Amer. Ent. Soc., vol. 16, p. 211, 1889 (New Mexico and Arizona; type in Horn collection, Acad. Nat. Sci. Philadelphia).—JACOBY, Biol. Centr. Amer., vol. 6, suppl., p. 275, 1891.

Description.—Slender, oblong oval (4.5 mm), with lustrous and closely punctate green or blue elytra, the upper half of head also dark with metallic luster, lower front and prothorax pale, undersurface mostly dark, the abdominal margin, anterior femora, and basal half of posterior femora pale. Head with interocular space barely half width of head, carina slightly produced; a circle of coarse punctures on each side about fovea near eye; occiput, front, and usually tubercles dark with metallic luster, carina and lower part of head, except dark labrum, pale. Antennae dark brown with three basal joints paler; third point shorter than fourth or fifth, which are subequal, the fourth longer. Prothorax nearly rectangular, slightly convex, approximately twice as wide as long, sides a little arcuate; surface shining, very finely, sparsely and indistinctly punctate, entirely pale. Scutellum black. Elytra lustrous green or blue, closely but shallowly and sometimes rugosely punctate; somewhat convex, sides parallel, humeri well marked, a short intrahumeral sulcus within. Body beneath lightly and indistinctly pubescent, mesosternum, metasternum, and middle of abdomen dark shin-

ing brown, often with metallic luster, margins more or less pale; femora of anterior legs and basal half of posterior femora usually pale, this coloring somewhat variable in extent. Length, 4.3 to 5.2 mm; width, 2.2 to 2.8 mm.

Type locality.—New Mexico (as here restricted).

Distribution.—Arizona (Chiricahua Mountains, Clemenceau, Cochise County, Gila Valley, Globe, Graham County, Huachuca Mountains, Patagonia Mountains, Santa Rita Mountains); New Mexico (Deming, Las Vegas, Mesilla, Sandia Mountains); Kansas (Douglas County); Mexico and Guatemala.

Food plant.—*Amaranthus palmeri* S. Watson (Brisley).

Remarks.—This species, described from New Mexico and Arizona, also occurs in Kansas and extends southward through Mexico at least to Guatemala. It is easily recognized by its bright lustrous elytra, which are more densely punctate than in any other dark-colored species except *triangularis*. The diagonally separated colors of the posterior femora are striking. This pattern, however, is not peculiar to this species, as many specimens of *wanthomelas* show a similar marking.

29. *DISONYCHA VARICORNIS* Horn

PLATE 6, FIGURE 34

Disonycha varicornis HORN, Trans. Amer. Ent. Soc., vol. 16, p. 210, 1889 (Texas and Peninsula of California; type in Horn collection, Acad. Nat. Sci. Philadelphia).

Description.—Robust, oblong oval, with lustrous blue or purple, rarely green elytra, and pale head, prothorax, and undersurface, except for darkened tibiae and tarsi and apex of hind femora. Head with interocular space barely half width of head; interantennal area scarcely carinate, not at all produced; a circle of coarse punctures about fovea on each side near eye; entirely pale except labrum, which is occasionally brown. Antennae with third, fourth, and fifth joints subequal, the fourth slightly the longest; first 4 and last 1 or 2 pale, the rest reddish brown. Prothorax approximately twice as wide as long, convex, without depressions, sides with explanate margin widening anteriorly and slightly notched behind the apex; surface shining, very indistinctly punctate, entirely pale, sometimes with indefinite pale brown shadings suggestive of spotting. Scutellum usually black, occasionally dark reddish brown. Elytra lustrous blue or purple, rarely green, minutely and not densely punctate; broadly oblong and convex, with humeri well marked and a short intrahumeral sulcus. Body beneath shining, very indistinctly pubescent, pale, the tibiae and tarsi and apex of posterior femora reddish brown. Length, 5 to 6.2 mm; width, 3 to 3.3 mm.

Type locality.—Texas (as here restricted).

Distribution.—Texas (Beeville, Brownsville, Corpus Christi, Harlingen, New Braunfels, San Diego, Sharpsburg); California (San Diego); Lower California (Santa Rosa, San Felipe).

Food plants.—*Opuntia leptocaulis* and *O. arborescens* (Hunter, Pratt, Mitchell).

Remarks.—*D. varicornis* is unlike any North American *Disonycha* in the shape of its prothorax. The broadened apical angle of the explanate margin and the notching behind the angle on the margin, together with the varicolored antennae, are distinguishing characters for this species. It is closely related to *D. mexicana* Jacoby, which has a similarly shaped prothorax but has entirely brown antennae with the third antennal joint much shorter than the fourth. The legs of *mexicana* are paler, and the aedeagus quite unlike that of *varicornis*.

30. DISONYCHA FUNEREA (Randall)

PLATE 6, FIGURE 35

Haltica funerea RANDALL, Boston Journ. Nat. Hist., vol. 2, p. 47, 1838 (Canton, Mass.; type lost).

Disonycha funerea CROTCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873.—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 208, 1889.

Description.—Elongate oval, entirely lusterless black except the last 2 or 3 ventral segments, which are more or less pale yellow; antennae short and heavy. Head with the interocular space over half width of head; interantennal area not carinate, but flat and broad; tubercles rather indefinitely marked; surface dull black, distinctly alutaceous with a few scattered punctures on each side about fovea near eye. Antennae black, not extending much below humeri, third and fourth joints subequal with fourth slightly longer, remainder a little shorter, all nearly as broad as long. Prothorax scarcely twice as broad as long, convex, somewhat narrowed anteriorly with sides nearly straight; surface entirely dark, lusterless, distinctly alutaceous, with fine and moderately dense punctation. Scutellum black. Elytra elongate oval without humeral prominences, convex; surface entirely lusterless black, distinctly alutaceous, finely punctate. Body beneath alutaceous, nearly glabrous, dark except the last 2 or 3 ventral segments, which are either entirely pale or with pale margins, the last segment being entirely pale; legs black. Length, 6 to 6.8 mm; width, 2.8 to 3.5 mm.

Type locality.—Canton, Mass.

Distribution.—Massachusetts (Brighton, Sherborn, Wellesley); Connecticut (Old Lyme); Georgia (Thomas County); Alabama (Mobile).

Food plant.—Unknown.

Remarks.—This is the most curious and probably one of the rarest of North American species of *Disonycha*. In its dull black coloring and heavy antennae it is suggestive of *Oedionychis lugens*. So few specimens are known to the writer that each is worthy of mention. There are three specimens in the old Harris collection in the Boston Society of Natural History, taken in Brighton, Mass., in a dry pasture under a stone on October 26, 1839. Two specimens are in the LeConte collection at Cambridge, one of which bears the same label as those in the Harris series, and the other is without label. There is one specimen in the Bowditch collection labeled Colorado, which is doubtless a mistake as it might easily have been confused in some collection with *Oedionychis lugens*, which occurs in that locality, and later wrongly labeled. There are 2 specimens in the Horn collection, 1 from Georgia and 1 without label. C. A. Frost possesses a specimen taken by A. P. Morse at Wellesley, Mass., and there is one at the Connecticut Agricultural Experiment Station taken at Old Lyme, Conn. H. P. Loding collected a specimen at Mobile, Ala. In the National Museum are two specimens, one collected by E. J. Smith at Sherborn, Mass., and secured for the Museum by C. A. Frost, and the other, presented to the Museum by W. L. McAtee, was found in the stomach of a quail (*Colinus virginianus*) collected by H. M. Hanna, February 2, 1927, at Melrose Plantation, Thomas County, Ga.

31. *DISONYCHA BREVICORNIS* Schaeffer

PLATE 8, FIGURE 42

Disonycha brevicornis SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 281, 1931 (Colorado; type in collection Charles Schaeffer).

Description.—Small (5.8 mm), not depressed, oblong, faintly shining, yellow, head with occipital band, tubercles, and labrum dark, pronotum heavily spotted, elytra with usual median, sutural, and submarginal vittae; body beneath dark with base of femora, the tibiae, and the tarsi dark. Head with interocular space more than half width of head; smooth except for a few coarse punctures on sides near eye; tubercles distinct, interantennal area slightly produced; a broad, dark, occipital band extending to and covering tubercles; carina in part and labrum dark. Antennae extending to a little below humeri, dark with paler basal joints, fourth longer than third and fifth, which are subequal. Prothorax scarcely twice as broad as long, without callosities, sides arcuate, narrowed anteriorly; surface finely alutaceous and finely punctate; 5 pronotal spots, the 3 median tending to coalesce and the 2 lateral ones large.

Scutellum dark. Elytra with dark sutural, median, and submarginal vittae, the sutural and submarginal not joined at apex; humeri not prominent, a short intrahumeral sulcus; median dark vitta with a slight ridging extending from below humerus the length of the elytral vitta; surface finely alutaceous and finely punctate. Body beneath finely pubescent; mesosternum, metasternum, and abdomen except last segments dark; base of femora, the tibiae, and the tarsi darkened. Length, 5.8 mm; width, 3 mm.

Type locality.—Colorado. (One paratype, a male, in collection of U.S. National Museum.)

Remarks.—Mr. Schaeffer has sent me 1 of his 3 specimens of *D. brevicornis* for examination and has donated it to the National Museum (U.S.N.M. No. 4114). This species is most distinct and unrelated to any other north of Mexico. It does not belong to the *pennsylvanica* group, although it resembles that group in the dark marking of the head and undersurface and the suggestion of an elytral costa. The antennae are shorter than in that group, and the prothorax is longer and more convex, without depressions or callosities. The aedeagus is quite unlike any that I have seen in any other *Disonycha*.

The specimens bear simply the old label "Col.," and since their source also is obscure, material from a more definite locality is needed to corroborate the locality Colorado.

32. DISONYCHA STENOSTICHA Schaeffer

PLATE 8, FIGURE 43

Disonycha stenosticha SCHAEFFER, Journ. New York Ent. Soc., vol. 39, p. 285, 1931 (Brownsville, Tex.; type in collection Charles Schaeffer).

Description.—Large (7 mm), broadly oblong, not depressed, shining, pale yellow, tip of mandibles, antennae, tarsi, and very narrow sutural, median, and submarginal elytral vittae dark. Head pale with tip of mandibles darkened; shining, smooth, only a few punctures on each side about fovea; frontal tubercles not swollen; interantennal area slightly produced, rounded; interocular space about half width of head. Antennae extending about to middle of the elytra, dark, with three basal joints paler; fourth joint longer than third or fifth, and fifth longer than third. Prothorax about twice as wide as long, convex, without callosities; sides slightly arcuate and narrowed anteriorly; surface smooth, shining and nearly impunctate; faint traces of four brownish spots, but no trace of median line. Elytra broadly oblong, with humeri well marked, a short intrahumeral sulcus within; surface smooth, shining, nearly impunctate; elytral vittae very narrow, the submarginal vitta becoming indistinct

at base and apex, and not joining at apex with sutural vitta; the sutural vitta extending about scutellum. Body beneath pale, covered with fine pale pubescence, tibiae slightly darker at apex and tarsi dark. Length, 7 mm; width, 4 mm.

Type locality.—Brownsville, Tex., collected January 17, 1923, collector's name not given.

Remarks.—Mr. Schaeffer has lent me his type specimen, a female, for examination. Its sides are more parallel than those of the *discoidea* group, which it most resembles, and the elytral humeri are more pronounced. Although a smaller species, its smooth, brilliant surface, narrow vittae, and oblong shape suggest *Cacoscelis quinquevittata* Latreille, and it may be a connecting link between this group and the *discoidea* group. Except for the paler tibiae, it corresponds with Jacoby's description of *D. militaris*, described from Mexico and Central America, and also with my notes on that species, a cotype of which is in the Bowditch collection in the Museum of Comparative Zoology. Until a restudy of the Jacoby type series can be made, the present species may stand as distinct.

DOUBTFUL SPECIES

Cistela quinquevittata FABRICIUS, Syst. Ent., p. 118, 1775 (Carolina); Spec. Ins., vol. 1, p. 148, 1781; Man. Ins., vol. 1, p. 86, 1787.

Cistela svittata FABRICIUS, Ent. Syst., vol. 1, pt. 2, p. 47, 1792.

Disonycha quinquevittata GEMMINGER and HAROLD, Catalogue, vol. 12, p. 3496, 1876 (as synonym of *D. caroliniana*).—HORN, Trans. Amer. Ent. Soc., vol. 16, p. 315, 1889 (as synonym of *D. caroliniana*).

“Testacea, elytrorum marginibus vittaque media nigris. Habitat in Carolina. Dom. Monson. Corpus testaceum, antennis nigris, serratis. Elytra rufescentia, margine omni vittaque in medio uniuscuiusque elytri nigris. Femora postica valde incrassata, intus canaliculata” (Fabricius, 1775).

Fabricius (1775) first called this *Cistela quinquevittata*, but in 1792 he gave the name as *C. svittata* (evidently a typographical error for *5-vittata*) and suggested that it might possibly be a chrysomelid. In 1801 he still further abbreviated it to *C. vittata* (possibly influenced by Olivier, 1789,³⁰ who listed an *Altica vittata*), and at the same time doubtfully synonymized it with *Galleruca caroliniana*.³¹

The identity of *Cistela quinquevittata* with *Disonycha caroliniana* has never been properly established. Gemminger and Harold appear to be responsible for referring it to synonymy with *D. caroliniana*. Whether their use of the name *quinquevittata* invalidates Say's name *quinquevittata* applied to a different species is an open question.

³⁰ Olivier, Encyclopédie méthodique, vol. 4 (Insects, vol. 1), p. 105, 1789 (*A. glabrata* cited as synonym).

³¹ Fabricius, Systema Eleutheratorum, vol. 1, p. 491, 1801.

Altica mellicollis SAY, Descriptions of new species of North American insects found in Louisiana by Joseph Barabino, p. 10, 1831 (Louisiana); Boston Journ. Nat. Hist., vol. 1, p. 199, 1835 (Missouri). (The original description is published in a rare publication, a copy of which is in the Boston Society of Natural History, and was printed by the "School Press, New Harmony.")

"*A. mellicollis*, Head black; thorax yellowish; elytra blue. Inhab. Louisiana. Head blue-black, with rather large punctures each side, between the antennae convex, dark piceous; antennae black brown, three basal joints honey yellow beneath: palpi black: thorax pale honey yellow, punctures not obvious: scutel impunctured: elytra with numerous, small, distant punctures, not profound, dark violaceous blue: pectus yellowish: postpectus blackish: venter blackish, last segment dull yellow: thighs honey yellow; tibiae black, yellowish at base: tarsi black. Length nearly one fifth of an inch. Related to *collaris* Illig. and *collata* Fabr., particularly the latter, from which it may be distinguished by its blue elytra, and immaculate face." This species is discussed under *D. collata*.

Haltica vicina KIRBY, Fauna Boreali Amer., vol. 4, p. 217, 1837 (Canada; type lost).

"Pallida, pectore, capite punctis tribus; prothorace quatuor lineolaque, coleoptris vittis quinque, tarsisque, nigris. L. body $3\frac{1}{3}$ lines." K. G. Blair, of the British Museum, writes that the type of this species has been lost. From the description it might be either *D. uniguttata* or *D. procera*.

Disonycha limbicollis var. *pallipes* CROUCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 64, 1873. (Type locality not given; type not in Crouch's collection in England or in this country so far as can be found.)

"Elytra yellow with black vittae.

Under surface pubescent.

Thorax short, sides broadly reflexed with a marked callus, head black.

Legs and under side black.

Hind femora at least and part of the body red. *V. pallipes*."

This variety has been discussed under *D. procera* and *uniguttata*.

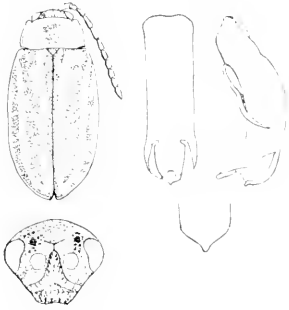
Altica quinquevittata SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 4, p. 85, 1824 (Missouri).

"Yellowish: thorax 4- or 5-spotted; elytra 5-lined. Inhabits Missouri. Body oblong-oval, yellowish, glabrous; antennae black, 3 basal joints rufous beneath; thorax with an abbreviated, black line in the middle of the posterior submargin, and a semicircular series of 4 equal, equidistant, suborbicular black spots; posterior edge concave at the scutel; scutel black; elytra with a common sutural fillet; each elytron with a fillet originating at the humerus and terminating

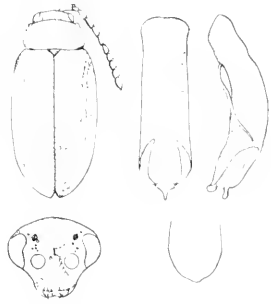
near the tip, and another marginal, less dilated fillet, confluent with the sutural vitta at tip; region of the origin of the posterior feet black; thighs rufous; tarsi, and a line on the superior edge of the 2 anterior pairs of thighs together with a line on the inferior edge of the tibiae, black. Length more than three tenths of an inch.

“The arrangement of the lines of the elytra are similar to those of *A. caroliniana* Fabr. The head is sometimes black at base and the two intermediate thoracic spots are confluent. Found in considerable numbers on common elder (*Sambucus*) and some other shrubs. On the evening of the 16th of June, I observed great numbers of these flying in a southeast direction from near St. Louis, obliquely across the Mississippi towards an island, the wind at the same time blowing moderately from the eastward; the subsequent evening, about the same hour, they returned by the same route reversed, the wind directly opposing them; both of these days were very warm. During our progress up the Missouri River, I observed several times similar migrations of this species.”

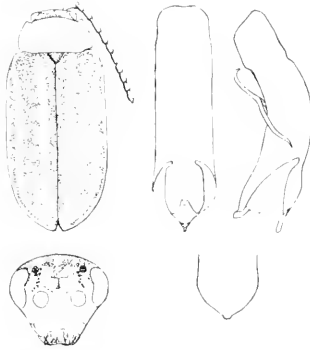
I have been unable to learn of any species of *Disonycha* that feeds on elder. In view of the fact that elder frequently grows in the same locality with willow and the fact that these insects were exceedingly abundant, Say may have seen specimens on elder although the willow was the real food plant. This is indicated in his statement that they occurred on “some other shrubs.” His description unfortunately applies equally well to three species of *Disonycha*, all of which occur in the locality given—*alternata*, *pluriligata*, and *punctigera*. For further discussion, see remarks under those species.



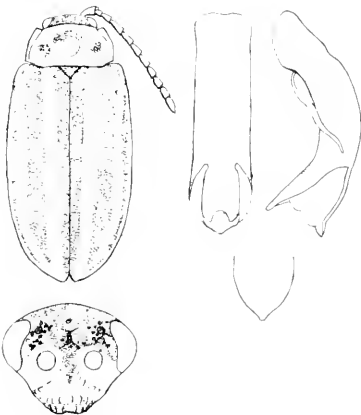
1. *pensylvanica*



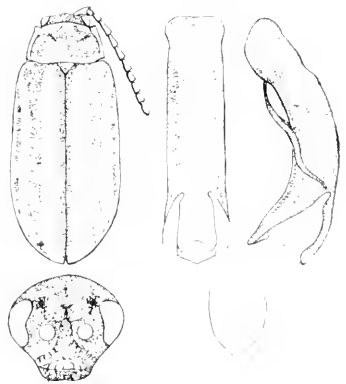
2. *conjugata*



3. *procerca*



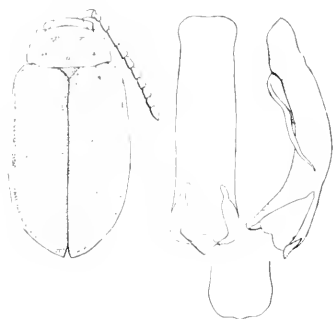
4. *uniguttata*



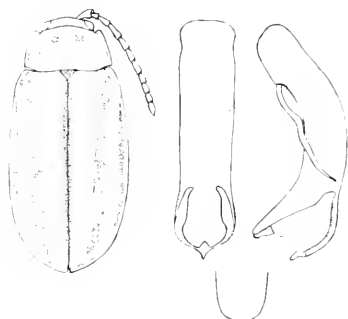
5. *limbicollis*

BETLES OF THE GENUS DISONYCHA.

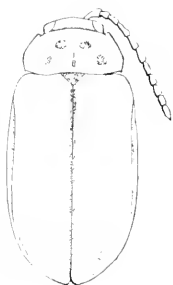
- 1, *Disonycha pensylvanica* (Illiger); 2, *D. conjugata* (Fabricius); 3, *D. procerca* Casey; 4, *D. uniguttata* (Say);
5, *D. limbicollis* (LeConte).



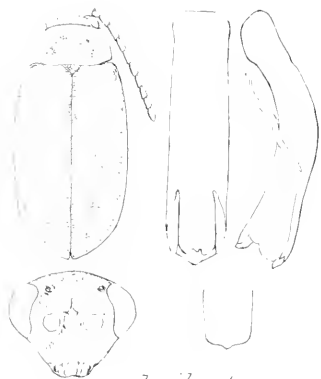
6. *latiovittata*



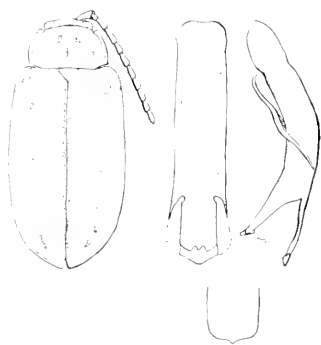
7. *schaefferi*



8. *alternata*



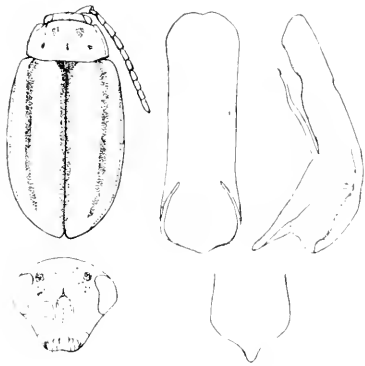
9. *pluriligata*



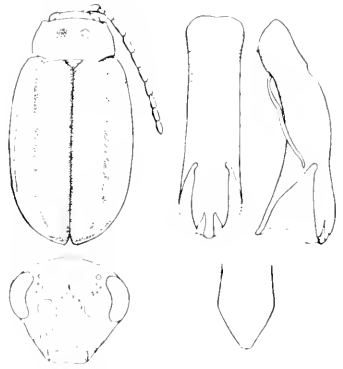
10. *pluriligata* var. *pura*

BETLES OF THE GENUS DISONYCHA.

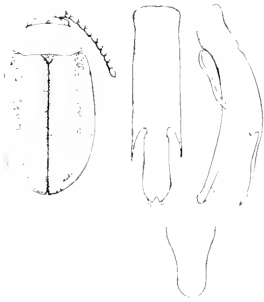
6, *Disonycha latiovittata* Hatch; 7, *D. schaefferi*, new species; 8, *D. alternata* (Illiger); 9, *D. pluriligata* (LeConte); 10, *D. p.* var. *pura* (LeConte).



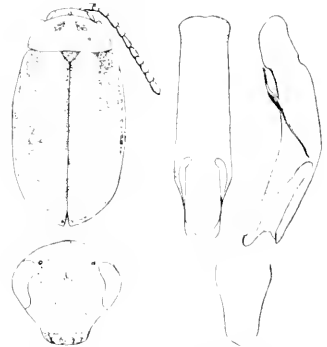
11. *punctigera*



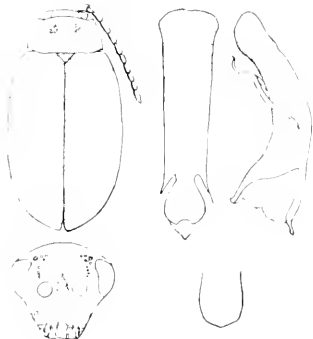
12. *tenuicornis*



13. *arizonae*



14. *arizonae* var. *borealis*



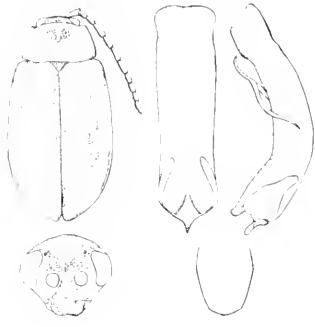
15. *figurata*



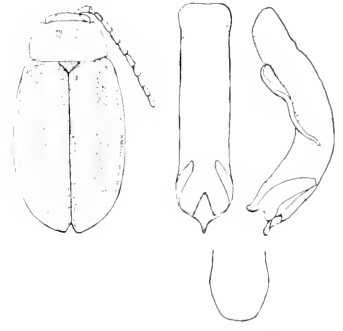
16. *caroliniana*

BEETLES OF THE GENUS DISONYCHA.

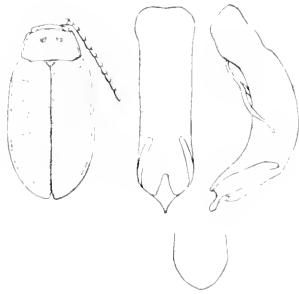
11, *Disonycha punctigera* LeConte; 12, *D. tenuicornis* Horn; 13, *D. arizonae* Casey; 14, *D. a. borealis*, new variety; 15, *D. figurata* Jacoby; 16, *D. caroliniana* (Fabricius).



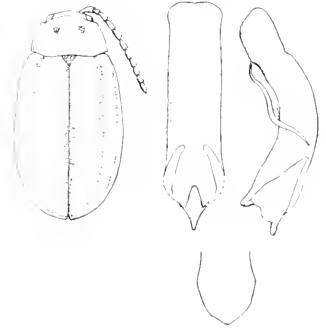
17. *fumata*



18. *fumata* var. *lodingi*



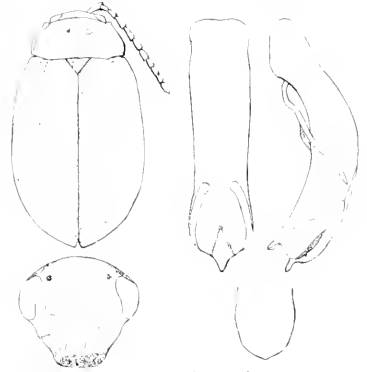
19. *fumata* var. *quinqnerutata*



20. *latifrons*



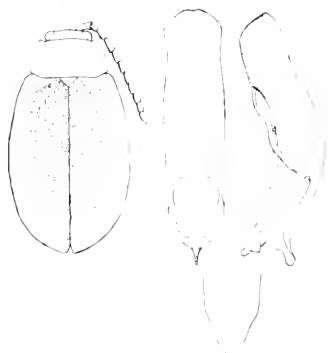
21. *latifrons* var. *asteris*



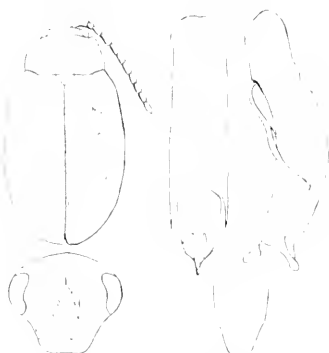
22. *latifrons* var. *laticollis*

BEETLES OF THE GENUS DISONYCHA.

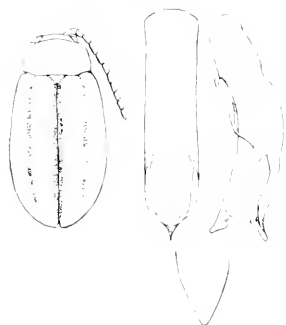
17, *Disonycha fumata* (LeConte); 18, *D. f.* var. *lodingi* Schaeffer; 19, *D. f.* var. *quinqnerutata* Schaeffer; 20, *D. latifrons* Schaeffer; 21, *D. l.* var. *asteris* Schaeffer; 22, *D. l.* var. *laticollis* Schaeffer.



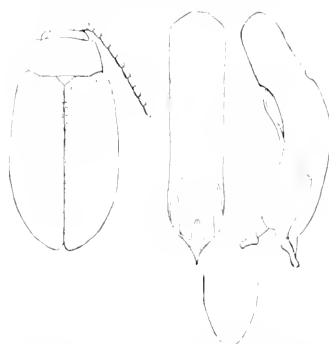
23. *discoidea*



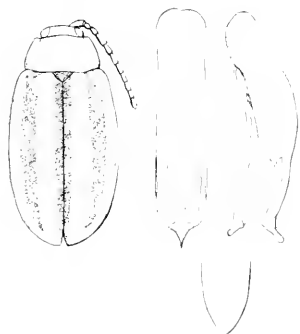
24. *discoidea* var. *abbreviata*



25. *leptolineata* (from Florida)



26. *leptolineata* (from Virginia)



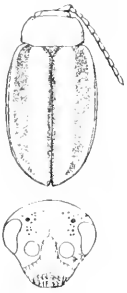
27. *leptolineata* var. *tzana*



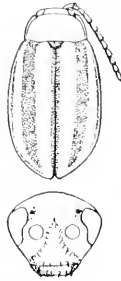
28. *antennata*

BETLES OF THE GENUS *DISONYCHA*.

23, *Disonycha discoidea* (Fabricius); 24, *D. d.* var. *abbreviata* Melsheimer; 25, *D. leptolineata* Blatchley, Florida specimen; 26, *D. leptolineata*, Virginia specimen; 27, *D. l.* var. *tzana* Schaeffer; 28, *D. antennata* Jacoby.



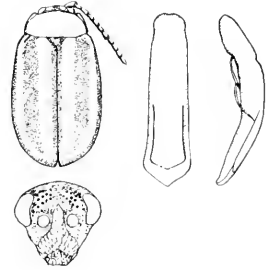
29. *alabamiae*



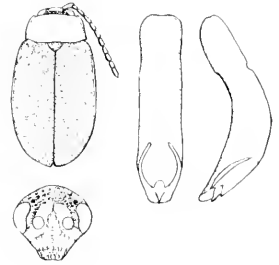
30. *admirabilis*



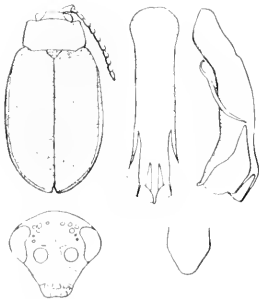
31. *maritima*



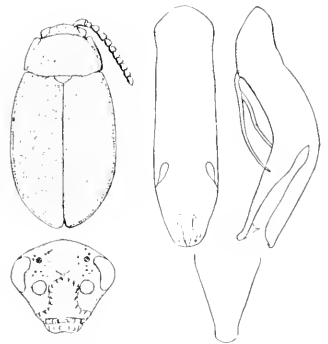
32. *glabrata*



33. *semicarbonata*



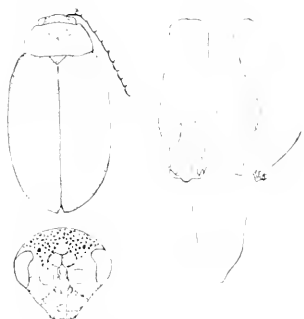
34. *varicornis*



35. *funerea*

BETLES OF THE GENUS DISONYCHA.

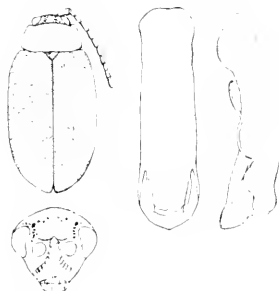
29, *Disonycha alabamiae* Schaeffer; 30, *D. admirabilis* Blatchley; 31, *D. maritima* Mannerheim; 32, *D. glabrata* (Fabricius); 33, *D. semicarbonata* LeConte; 34, *D. varicornis* Horn; 35, *D. funerea* (Randall).



36. *triangularis*



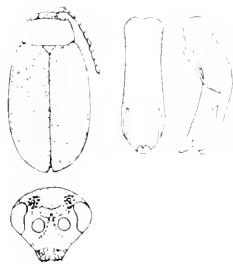
37. *triangularis* var. *montanensis*



38. *xanthomelas*



39. *xanthomelas* var. *atrata*



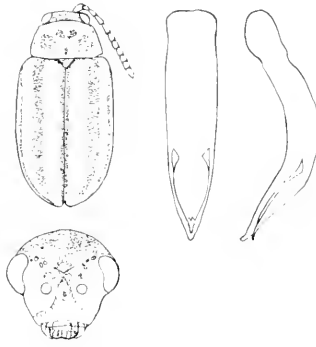
40. *politula*



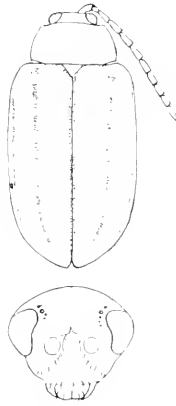
41. *colata*

BETLES OF THE GENUS DISONYCHA

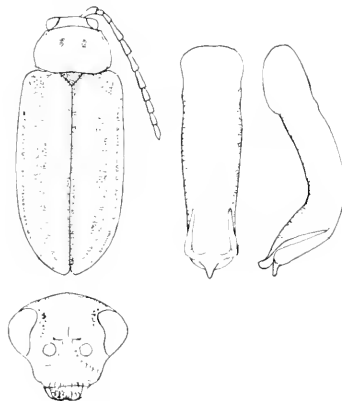
36, *Disonycha triangularis* (Say); 37, *D. t. montanensis*, new variety; 38, *D. xanthomelas* (Dalmat);
39, *D. x. atrata*, new variety; 40, *D. politula* Horn; 41, *D. colata* (Fabricius).



42. *brevicornis*



43. *stenosticha*



44. *teapensis*

BETLES OF THE GENUS DISONYCHA.

42, *Disonycha brevicornis* Schaeffer; 43, *D. stenosticha* Schaeffer; 44, *D. teapensis*, new species.

THREE NEW CHIGGER MITES OF THE GENUS *TROMBICULA* FROM PANAMA. WITH A KEY TO THE KNOWN ADULTS OF *TROMBICULA* OF THE NEW WORLD

By H. E. EWING

Bureau of Entomology, United States Department of Agriculture

Three new species of the genus *Trombicula* were contained in a small collection of mites sent in for identification from Panama, by L. H. Dunn, medical entomologist of the Gorgas Memorial Laboratory, Ancon, Canal Zone. Two of these are represented by adult specimens taken from caves. These cave species are blind, and in addition one of them differs from any known described species in having the tarsal claws of the first pair of legs trifurcate. At first the writer was inclined to establish a new genus for this species, but he decided that it probably represents a form already known in the larval stage.

Until many more rearings are made it will be best to use larval characters for our genera of chigger mites, as less than one species in 10 is known from the adult stage. Eventually, however, this process will probably be reversed, and our genera of the Trombiculinae will be based chiefly on adult characters.

The known adults of *Trombicula* of the New World may be separated by the following key:

KEY TO ADULTS OF THE GENUS *TROMBICULA* OF THE NEW WORLD

1. Claws of first pair of legs simple, not trifurcate..... 2
Claws of first pair of legs trifurcate distally; this pair not only much larger than the others but also much more sclerotized.
trifurca, new species
2. Eyes present and well developed; setae of body but slightly longer on posterior margin than on shoulders, and colored..... 3
Eyes vestigial or absent; setae of body usually considerably longer on posterior margin than on shoulders..... 5
3. Eyes with strongly convex corneas and situated far in front of base of dorsal groove; length of adults, over 2 mm..... 4
Eyes with corneas less convex and situated approximate, laterally, to expanded base of dorsal groove; length of adults about 1 mm..... *irritans* (Riley)

- 4. Setae of body shorter and distinctly barbed to tips, those on shoulders about half as long as femur I-----alleei Ewing
- Setae of body longer and indistinctly barbed toward tips, those on shoulders about as long as femur I-----peruviana Ewing
- 5. Pseudostigmatic area angulate laterally and with a pair of posterior, diverging, curved processes-----cavernarum, new species
- Pseudostigmatic area rounded laterally and without diverging posterior processes----- 6
- 6. Posterior lobes of pseudostigmatic area smaller, more or less angulate and situated immediately behind pseudostigmata.
 - coarctata Berlese
- Posterior lobes of pseudostigmatic area larger, rounded, and not situated behind pseudostigmata-----splendens Ewing

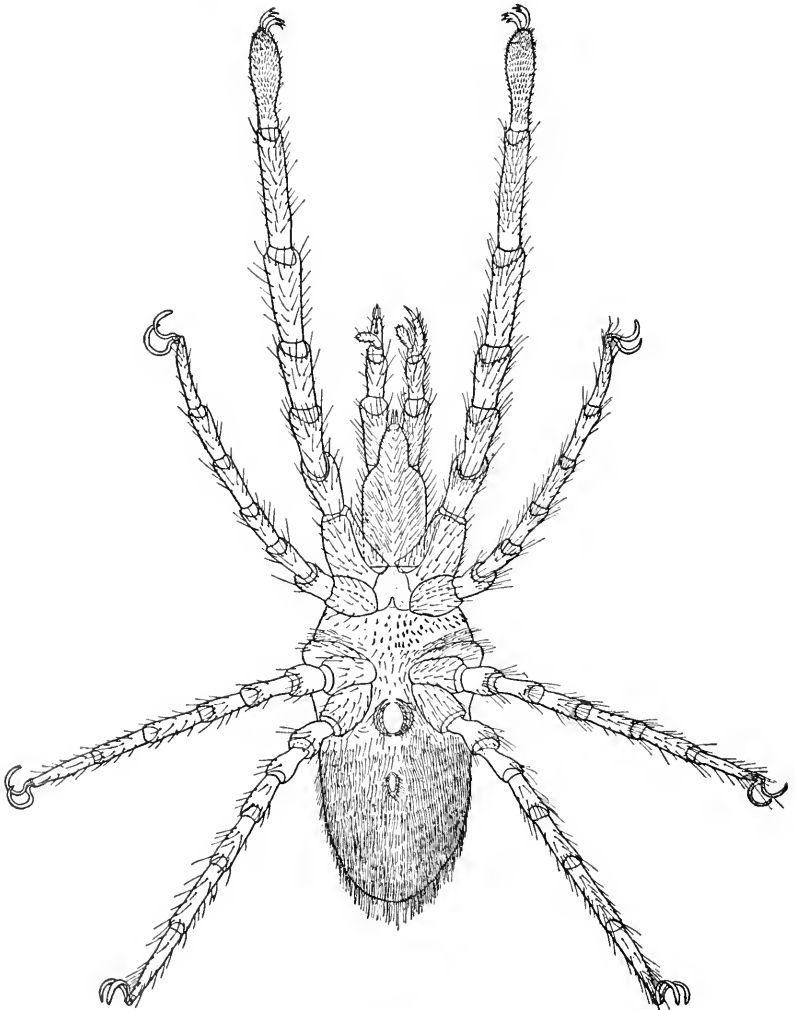


FIGURE 1.—Ventral view of *Trombicula trifurca*, new species. (Drawn by Eleanor A. Carlin.)

DESCRIPTIONS OF NEW SPECIES

The first two descriptions given here are based on adults, the third upon larvae. The adults have been cleared in potassium hydroxide, and in the case of one species have been stained in addition. This staining has brought out the male genital armature, which is described probably for the first time for any species. It will be interesting to note whether this character will be of value in the differentiation of closely related species.

TROMBICULA TRIFURCA, new species

FIGURE 1

Adult.—Slender, with anterior pair of legs, mouth parts, and anterior part of cephalothorax darker and more sclerotized than the other parts. Mouth parts situated on a more or less distinct capitulum, which has parallel sides and is terminated below in a large, trowel-shaped hypostome. Palpi slender, extending to about the middle of first patellae; palpal claw weak, slightly curved, about two thirds as long as segment which bears it; palpal thumb very slightly swollen, reaching base of palpal claw; only one accessory spine present, which is about one half as broad as palpal claw. Chelicerae very long and slender, basal segment about four fifths as long as capitulum; chela slender, with a sharp upper edge. Crista broad, platelike, with pseudostigmatic area reduced and near the posterior end; pseudostigmata small, circular, and far apart; pseudostigmatic organs apparently absent. Eyes absent. Abdomen fully twice as long as broad and with the usual constriction at the level of third and fourth coxae; setae longest around posterior margin. Genital opening large, situated about half its diameter from fourth pair of coxae; genital suckers six, first pair slightly larger than the others. Anal opening about half as broad and two thirds as long as genital opening, and situated about its greatest diameter from the latter. Coxae of first two pairs of legs united to a sternum and those of first pair each expanded along its anterior margin into a shelf-like lamella. Anterior pair of legs much larger and longer than the others and each ending in a pair of trifurcate claws. Legs II and III rather weak, subequal; legs IV considerably stouter and longer; claws of legs II, III, and IV simple, but inflated toward the tips. Length, 2.7 mm; width, 0.9 mm.

Type locality.—Chilibrillo Caves, Panama.

Type slides.—U.S.N.M. no. 1063.

Remarks.—Described from four mounted and cleared adults, in nature found crawling on the walls of Chilibrillo Caves, Panama, by L. H. Dunn. Evidently this species does not belong to *Trombicula*, but, for reasons stated at the beginning of this paper, it is for the present placed there. Its larvae probably parasitize bats.

TROMBICULA CAVERNARUM, new species

FIGURE 2

Adult.—Moderate in size and of the shape typical of the genus. No capitulum present. Palpi reaching beyond the middle of the first patellae; palpal claw weak, but little over half as long as the arched segment which bears it; accessory spines four, subequal, forming a

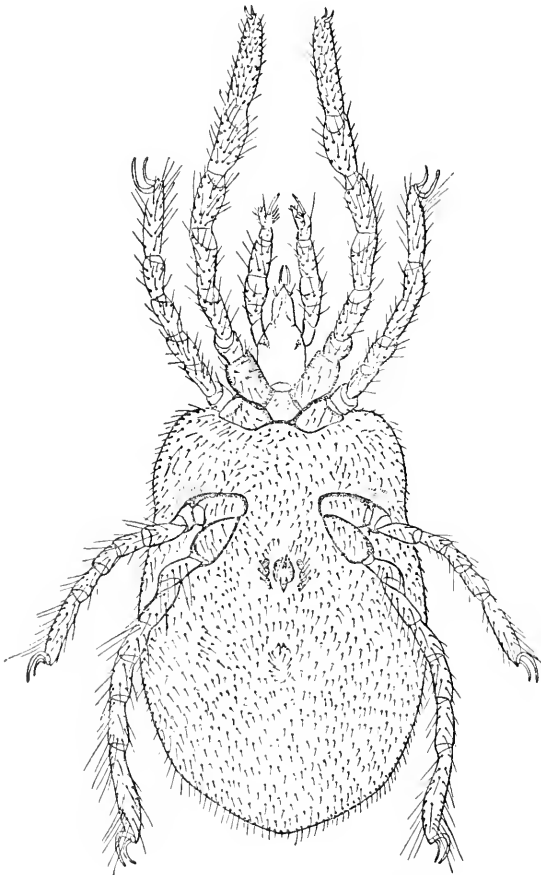


FIGURE 2.—Ventral view of male of *Trombicula cavernarum*, new species. (Drawn by Eleanor A. Carlin.)

comb; palpal thumb slightly swollen and extending to middle of palpal claw. Chelicerae very slender; chelae slender, sharp, tips extending slightly beyond the tips of second palpal segments. Crista rodlike, expanded near its posterior end into a diamond-shaped pseudostigmatic area slightly beyond which the crista ends in two strongly diverging lateral arms. Pseudostigmata moderate, situated near lateral angles of pseudostigmatic area; pseudostigmatic organs very long, setiform, with two barbs. Eyes absent. Abdomen about one and a half times as long as broad; setae short for the genus. Genital opening

about one half of its diameter from posterior coxae. Genital armature of male composed of a basal plate, a protruding penis, and an inwardly projecting manubrium; basal plate horseshoe-shaped; penis a cone-shaped, sclerotized structure, situated between the two arms of the basal plate; manubrium somewhat longer than penis and arising from base of the same. Anus somewhat smaller than genital opening and situated about one and a half times its greatest diameter behind the same. Anterior legs only slightly larger than posterior.

Tarsal claws all simple, those of the first legs quite small and subequal, those of the other legs unequal, the posterior claw being larger than the anterior. Length, 1.12 mm; width, 0.7 mm.

Type locality.—Chilibrillo Caves, Panama.

Type slide.—U.S.N.M. no. 1064.

Remarks.—Described from two males and one female cleared in potassium hydroxide and stained with acid fuchsin. They were taken from the rock walls of caves at the type locality, by L. H. Dunn. This species is most nearly related to *T. coarctata* Berlese, from which it may be differentiated by having the pseudostigmatic area angulate laterally instead of rounded.

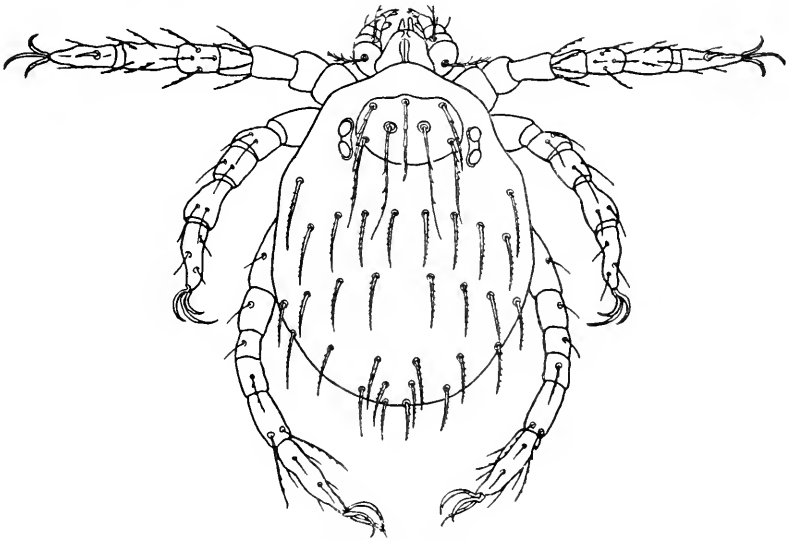


FIGURE 3.—Dorsal view of *Trombicula hominis*, new species. (Drawn by Mrs. Katherine Munroe.)

TROMBICULA HOMINIS, new species

FIGURE 3

Larva.—Palpi about reaching tips of chelicerae; second segment (palpal femur) about as broad as long and outwardly rounded laterally; first palpal seta subplumose, second with a few long barbs, third simple; palpal claw bifurcate, the outer prong larger than the inner and surpassing the latter, both sharp at apex. Chelicerae each with a single tooth on the upper margin and also on the lower margin. Dorsal plate porose, slightly broader than long, front margin incurved on each side of unpaired seta, posterior margin broadly and evenly outcurved; setae on dorsal plate all similar, those at the posterior corners somewhat longer than the others. Pseudostigmata circular, situated about halfway between the front and posterior

margins of dorsal plate and twice the diameter of either from each other; pseudostigmatic organs almost flagelliform, longer than dorsal plate, and with 3 to 5 inconspicuous barbs. Eyes well developed, posterior corneas distinct and almost as large as anterior ones. Dorsal abdominal setae 30 to 36. Dorsal spine of tarsus I rather short, slightly curved, and situated more than its length from base of segment. Length of unengorged specimens, 0.41 mm; width, 0.32 mm.

Type host.—Man.

Type locality.—Aguabuenas, Republic of Panama.

Type slide.—U.S.N.M. no. 1065.

Remarks.—Described from five specimens, mounted on type slide, taken from ear and scalp of child at hut near Aguabuenas, Republic of Panama, by L. H. Dunn. This species is most nearly related to *Trombicula brasiliensis* Ewing but has at least 30 dorsal abdominal setae, while *brasiliensis* has about 26 dorsal setae.

NEW GENERA AND SPECIES OF PARASITIC MITES OF THE SUPERFAMILY PARASITOIDEA

By H. E. EWING

Bureau of Entomology, United States Department of Agriculture

Parasitic mites of the superfamily Parasitoidea have long been recognized as of economic importance. In fact, one species, the common chicken mite, *Dermanyssus gallinae*, was studied and described by Redi in the seventeenth century. That these mites may be agents in the transmission of disease was demonstrated some years ago in the case of the common rat mite, *Echinolaelaps echidninus* (Berlese), which was shown to transmit a disease-producing protozoan among white rats. Recently another species, the tropical rat mite, *Liponyssus bacoti* (Hirst), has been implicated in the transmission of a disease of man, endemic typhus.

A study of the 15 species described as new in this paper has thrown much new light on generic characters in the group; in fact, it has resulted in the description herein of five new genera and a redescription of six old ones. The separation of certain members of the family Dermanyssidae from those of Parasitidae has always been difficult. It is here suggested that as far as the mouth parts are concerned the dividing point between the two families be based upon the presence on the chelicerae of either true teeth or cheliceral setae. If either one of these characters is present, the genus should be placed in the Parasitidae; if both are absent, it should be placed in the Dermanyssidae.

Family PARASITIDAE

Subfamily LAELAPINAE

ACANTHOCHELA, new genus

Body thickly beset with short and rather stout setae. Fixed arm of chelicera with several recurved, fanglike setae. Ventral plates of female as follows: Sternal plate about as broad as long and provided with many setae and two pairs of pores in the form of slits; genitoventral plate of moderate size, not reaching to the anal plate, and 3-lobed posteriorly; anal plate longer than broad, broadly

rounded in front and with three setae, the front two of which are paired. Legs rather short; second pair stouter than the others. Coxae II with a pair of spines; other coxae without spines.

Type species.—*Acanthochela chilensis*, new species.

Remarks.—Differs from *Haemogamasus* Berlese in having several recurved, fanglike setae on the fixed arm of the chelicerae and from *Euhaemogamasus*, described as new in this paper, in having many setae on the sternal plate.

ACANTHOCHELA CHILENSIS, new species

PLATE 1, FIGURE 1

Body about twice as long as wide and well provided with short setae. Palpi extending forward to tips of first patellae. Chelicerae moderate, fixed chela of each somewhat swollen toward the apex and bearing four recurved, thornlike setae. Sternal plate as broad as long, front corners produced, acuminate, with two pairs of pore slits and about 16 setae arranged more or less in pairs. Genito-ventral plate over twice as long as broad, broadest between the last pair of coxae, and ending in three lobes, the two lateral ones acuminate and the central one rounded. Anal plate one and a half times as long as broad; anus situated less than its diameter from the front margin; paired anal setae situated behind anus, single anal seta much larger than paired ones and extending beyond tip of anal plate. Legs of moderate length; second pair stoutest; third pair smallest; only second coxae bearing spines. Length of female, 0.69 mm; width, 0.39 mm.

Type host.—*Didelphis elegans*.

Type locality.—Lota, Chile.

Type slide.—U.S.N.M. no. 1066.

Remarks.—Described from four females, collected by D. S. Bullock, September 20, 1929, from type host, an opossum, at the type locality. A very distinctive species.

Genus HAEMOGAMASUS Berlese, 1889

This genus, as restricted in this paper, may be described as follows: Body thickly beset with short, fine setae. Fixed arm of chelicera not provided with recurved, fanglike setae. Ventral plates of female as follows: Sternal plate usually large, provided with many setae, some of which are not arranged in definite pairs; genitoventral plate not 3-lobed posteriorly; anal plate longer than broad, broadly rounded in front, and with three setae, the front two of which are paired. Legs rather slender, second pair the stoutest.

Type species.—*Haemogamasus hirsutus* Berlese, 1889.

Remarks.—The genus *Haemogamasus* Berlese is here restricted to species in which the sternal plate of the female is provided with many setae and the fixed arm of the chelicera is without recurved, fanglike setae.

HAEMOGAMASUS STERNALIS, new species

PLATE 1, FIGURE 2

Body about twice as long as broad and somewhat pointed at both ends, thickly beset with fine, slightly curved, subequal setae. Epistome of medium size, branches straight and sharp pointed. Chelicerae moderate, fixed chela slightly surpassing movable one and bearing an inflated seta near its tip. Sternal plate broader than long, posterior margin festooned, and bearing about 20 setae, including a pair of stout ones at the anterior corners. Genitoventral plate fully three times as long as broad, lateral margins concave, and bearing several setae. Anal plate broadly rounded in front and angulate behind; anus situated centrally; paired anal setae situated at the level of the anterior margin of anus; unpaired anal seta, subequal to paired ones, situated one half the distance from the posterior rim of the anus to the apex of anal plate. Legs slender; anterior and posterior pairs subequal and longer than the other pairs; all coxae without spines. Length of female, 0.92 mm; width, 0.52 mm.

Type host.—*Blarina brevicauda talpoides*.

Type locality.—Adirondack Lodge, Essex County, N.Y.

Type (holotype) slide.—U.S.N.M. no. 1067.

Remarks.—Described from a single female specimen taken by Francis Harper, August 12, 1925, from the caudal region of the short-tailed shrew at the type locality. This species is most nearly related to *Haemogamasus alaskensis* Ewing, 1925. It differs from *H. alaskensis* in having the sternal plate poorly sclerotized and festooned behind and in having the sternal setae arranged in irregular transverse rows.

EUHAEMOGAMASUS, new genus

Body thickly clothed with short setae. Fixed arm of chelicerae not provided with recurved, fanglike setae. Ventral plates of female as follows: Sternal plate short, usually broader than long, and provided with two or three pairs of setae; genitoventral plate expanded and broadly rounded posteriorly, never reaching anal plate; anal plate longer than broad, broadly rounded in front, and with three setae. Legs rather slender; coxae without spines.

Type species.—*Euhaemogamasus onychomydis*, new species.

Remarks.—This genus is most nearly related to *Haemogamasus* Berlese but is separated from it in having only a few sternal setae (four or six) arranged in pairs. In addition to the type, two other new species are included in it.

EUHAEMOGAMASUS ONYCHOMYDIS, new species

PLATE 1, FIGURE 3

Vestiture typical of the genus. Chelicerae large and powerful, the fixed chela in the case of the female longer than the movable one, not inflated, but strongly curved at the tip and provided with four or five dull teeth. Epistome large, broad at the base, fringed with sharp processes, most of which are curved and some of which are branched. Sternal plate broader than long, front margin incurved, its six subequal, curved setae arranged in two divergent rows; genitoventral plate much dilated and evenly rounded posteriorly, bearing many short, subequal setae and an anterior, submarginal pair much larger than the others; anal plate small, the longest anal diameter being over a third the length of the plate; paired anal setae situated opposite the middle of the anus. Legs moderate; second pair decidedly the stoutest; last pair the slenderest. Length of female, 0.93 mm; width, 0.61 mm.

Type host.—*Onychomys* sp.

Type locality.—Oraibi, Ariz.

Type (holotype) slide.—U.S.N.M. no. 1068.

Remarks.—Described from type specimen (a female) taken from type host, a grasshopper mouse, which was collected at the type locality June 4, 1927, by Paul E. Trapier. The specimen came through the United States Biological Survey. This species differs from the other two of the same genus, described in this paper, in the size and shape of the sternal plate and also of the genitoventral plate.

EUHAEMOGAMASUS UTAHENSIS, new species

PLATE 1, FIGURE 4

Body rather poorly clothed with setae. Movable chela of chelicera stout, armed with strong teeth, fixed arm modified into a straight, toothless, feelerlike process. Sternal plate greatly reduced in size, over twice as broad as long, front margin indefinite; it bears only the middle pair of sternal setae; genitoventral plate about three times as long as broad, sides incurved, and bearing about 10 setae; anal plate egg-shaped in outline, anus centrally placed, paired anal setae situated at the level of the anterior margin of the anus. Peritremes extending forward to the front coxae. Legs slender; first and last pairs subequal, longer than the others; second pair of legs stoutest. Length of female, 0.88 mm; width, 0.56 mm.

Type host.—*Neotoma lepida lepida*.

Type locality.—Salina, Utah.

Type (holotype).—U.S.N.M. no. 1069.

Remarks.—Described from a female specimen taken from type host, a wood rat, collected at the type locality by J. S. Sanford, March 21, 1929. This species is very distinctive in having a sternal plate so reduced that it bears only two of the six sternal setae.

EUHAEMOGAMASUS OREGONENSIS, new species

PLATE 2, FIGURE 1

Body almost twice as long as broad. The two chelae of each chelicera of equal length; movable one curved and with two teeth, both being on the outer margin; fixed chela almost straight, with two teeth and an inflated seta near the tip. Epistome conspicuous, with fringe of slender, pointed, and sometimes branched processes. Sternal plate broader than long, both anterior and posterior margins strongly concave and lateral angles produced into conspicuous processes. Genitoventral plate swollen and broadly rounded posteriorly, bearing about 20 setae, the front marginal pair of which are much larger than the others. Anal plate broadly rounded in front and produced posteriorly into an angulate process; anus large, situated centrally; anterior pair of anal setae situated opposite center of anus. Second pair of legs slightly enlarged, third pair the longest and slenderer than the others. Length of female, 0.98 mm; width, 0.63 mm.

Type host.—*Phenacomys albipes*.

Type locality.—Netarts, Oreg.

Type slide.—U.S.N.M. no. 1070.

Remarks.—Described from two females taken from type host, a forest tree mouse, collected at Netarts, Oreg., by Rosaline R. Walker, December 6, 1930 (Bishopp no. 14989). This species is characterized particularly by the produced lateral angles of the sternal plate.

CYCLOLAELAPS, new genus

Body almost circular and not thickly beset with setae; dorsal plate not sculptured, or but slightly so. Chelicerae without brush of setae, fixed arm without recurved, fanglike setae. Sternal plate of female broader than long, with two pairs of pores and three pairs of stout setae; genitoventral plate never reaching anal plate, provided with a single pair of setae; anal plate broad, rounded in front, pointed behind, and bearing three setae; metapodal plates very small, oval. Legs short, stout; coxae II and III each provided with a prominent spine or spur.

Type species.—*Cyclolaclaps circularis*, new species.

Remarks.—This genus is related to *Heterolaclaps* Hirst. It differs from *Heterolaclaps* in having but a single pair of setae on the genitoventral plate instead of five pairs. The type species only is included.

CYCLOLAELAPS CIRCULARIS, new species

PLATE 2, FIGURES 2-4

Body almost circular but observed to be slightly pointed in front and behind and sparsely clothed with rather short, spinelike setae, which are more conspicuous near the margin. Chelicerae with rather small chelae; movable chela much stouter than fixed one and surpassing the latter, with three teeth exclusive of the terminal process; fixed chela slightly curved, with two teeth exclusive of the terminal process, cheliceral seta absent. Sternal plate about twice as broad as long, front margin convex, posterior margin concave, the sternal setae subequal, curved, and forming two divergent rows. Genitoventral plate almost twice as long as broad, the single pair of setae extending to apex. Anal plate subtriangular, anal opening situated in front of center of same, paired anal setae shorter than unpaired one and situated on a level with posterior margin of anal opening. Metapodal plates oval, in diameter equal to that of anus. Legs stout; last pair longest; coxae I, II, and IV each with a single spinelike seta; coxae III each with two spinelike setae. Length of female, 0.65 mm; width, 0.55 mm.

Type host.—*Peromyscus truei truei*.

Type locality.—Salina, Utah.

Type slides.—U.S.N.M. no. 1071.

Remarks.—Described from two females taken from type host, the large-eared deer mouse, collected at the type locality by J. S. Stanford, one on November 22, 1928, and one on December 7, 1928.

Genus MACROLAELAPS Ewing, 1929

Body stout, but longer than broad, not subcircular; well clothed with short, spinelike setae; dorsal plate of female sculptured. Chelicerae each with a brush of setae attached near the base of the movable arm; fixed arm without recurved, fanglike setae. Sternal plate of female broad, with two pairs of pores and three pairs of setae; genitoventral plate not reaching anal plate; anal plate about as broad as long, broadly rounded in front and pointed behind, and provided with two paired and one unpaired setae. Legs stout, provided with spinelike setae; each coxa with one or two short, peglike spines.

Type species.—*Laclaps sanguineus* Vitzthum.

Remarks.—Species of this genus are the largest of any belonging to the subfamily Laelaptinae. The genus is related to *Geneiadolaelaps* Ewing, but differs from it in having the body sculptured above and the legs and body clothed with stout, spinelike setae.

MACROLAELAPS PERUVIANUS, new species

PLATE 2. FIGURES 5, 6

A large, robust species; body sparsely clothed with short, spine-like setae. Chelicerae large and powerful; brush of setae near base of movable chela present; fixed chela equal to movable one, curved, with three teeth and a straight, noninflated seta; movable chela strongly curved, with two teeth. Sternal plate about as broad as long, anterior and lateral angles acuminate, posterior margin broadly notched, pores conspicuous, sternal setae very long, curved, subequal. Endopodal plates distinct, much longer than broad; endopodal setae equal and similar to sternal setae. Genitoventral plate longer than broad, only slightly inflated posteriorly, setae on same equal and similar to sternal setae. Anal plate small for the size of the mite, broadly rounded in front; anal opening central, much longer than broad; paired anal setae much smaller than the unpaired one and situated on the level of the center of anal opening. Legs stout; femur and patella of first pair each with a seta-bearing dorsal protuberance; second pair of legs considerably stouter than the others; all coxae spine-bearing. Length of female, 1.9 mm: width, 1.25 mm.

Type host.—"Wild rat."

Type locality.—Lima, Peru.

Type slides.—U.S.N.M. no. 1072.

Remarks.—Described from eight females taken as follows: Two from type host at type locality, by Dr. C. R. Eskey (no. 22); three by the same collector from "mice and rat", Peru, 1931; three by same collector from "wild rats", Peru, 1930. A very distinctive species.

HEMILAELAPS, new genus

Body stout, but oval in shape, not subcircular, not thickly beset with short setae, and not sculptured dorsally. Chelicerae without brushes of setae, fixed arm without recurved, fanglike setae. Sternal plate of female broad and with three pairs of setae; genitoventral plate longer than broad, not reaching anal plate, anterior margin indefinite, and bearing a single pair of setae; anal plate subtriangular, about as broad as long, with two paired and one unpaired setae. Legs stout; none calcarate; second and third coxae each with a stout, short, curved, sausage-shaped spine.

Type species.—*Hemilaelaps americanus*, new species.

Remarks.—This genus is rather closely related to *Neolaelaps* Hirst, from which it differs in having a normal instead of a greatly enlarged peritreme, and in having only a single pair of setae on the genitoventral plate instead of three pairs.

HEMILAEALAPS AMERICANUS, new species

PLATE 3, FIGURE 1

General appearance similar to that of a species of *Liponyssus*, the dorsal plate not covering the body, which in turn is almost bare of setae. Chelicerae of the type of the genus *Laelaps*; movable chela slightly curved, with three teeth; fixed chela almost straight, with two teeth. Sternal plate broader than long, anterior margin indefinite, posterior margin outwardly rounded; sternal setae short, curved, subequal, and arranged in two diverging lines. Endopodal plates indefinite; endopodal setae similar to sternal setae. Genitoventral plate about twice as long as broad, broadly rounded behind. Anal plate large, subtriangular. Legs stout; second pair not enlarged; femur I with spinelike setae above; coxae I and II each with a short, stout, sausage-shaped spine. Length of female, 0.64 mm; width, 0.33 mm.

Type host.—*Drymarchon corais melanurus*.

Type locality.—Brownsville, Tex.

Type (holotype) slide.—U.S.N.M. no. 1073.

Remarks.—Described from a female specimen taken from the type host, a snake—the indigo racer—collected at the type locality by Grace Wiley, April 12, 1930 (Bishopp no. 13900). This species, the type of its genus, combines the characters of the genera *Laelaps* and *Liponyssus*.

HEMILAEALAPS DISTINCTUS, new species

PLATE 3, FIGURE 2

Body stout; ventral plates poorly sclerotized, integument practically devoid of setae. Chelicerae moderate in size; movable chela with two teeth exclusive of terminal hook; fixed chela almost straight, with a single tooth and a small noninflated seta, ending in a clawlike hook. Sternal plate about as broad as long, front margin strongly convex, posterior margin concave, anterior angles acuminate; sternal setae very small, arranged in two divergent rows. Genitoventral plate about twice as long as broad, but slightly inflated posteriorly, with two pairs of setae. Anal plate large, subtriangular, anus small, situated slightly in front of center; anal setae small, subequal. Legs short; femora I and II each somewhat inflated and bearing above a few spinelike setae; all coxae large, those of first and second pairs of legs each bearing a short stout spine. Length of female, 0.6 mm; width, 0.31 mm.

Type host.—*Elaphe obsoleta*.

Type locality.—Kentucky.

Type slide.—U.S.N.M. no. 1074.

Remarks.—Description based on five females taken from the type host, a black snake, from type locality, by R. E. Stadelman, September 29, 1927. This species differs from *H. americanus*, new species, in the characters of the chelicerae, the shape of the sternum, and a few other particulars.

Family DERMANYSSIDAE

Subfamily LIPONYSSINAE

Genus TETRAGONYSSUS Ewing, 1923

Body stout but longer than broad and clothed with spinelike setae; dorsal plate large, undivided. Chelicerae reduced, pointed as if for piercing. Sternal plate very broad, with three pairs of stout setae and tending to ankylose with endopodal plates; genitoventral plate large but not reaching anal plate; anal plate subtriangular, with two anterior, paired setae and one posterior, unpaired seta. Legs stout, particularly the first and second pairs; femora I and II enlarged and bearing dorsally long, stout, spinelike setae; tarsal claws small.

Type species.—*Liponyssus gigas* Oudemans, 1912.

Remarks.—This genus is very near *Myonyssus* Tiraboschi, 1904, and it is probable that it will need restriction in the future to characters some of which have in the past been considered as specific for its type species.

TETRAGONYSSUS MICROTI, new species

PLATE 3, FIGURE 3, 4

Female.—Body short, almost subcircular. Chelicerae rather stout: movable chela curved and irregularly bifurcate at tip; fixed chela almost straight and ending in a minute, strongly curved, sharp hook. Sternal plate in the form of a strongly curved arch; sternal setae large, arranged in two diverging rows. Endopodal plates well sclerotized, extending forward and matching sternal plate; endopodal setae similar to sternal setae. Genitoventral plate large, about as broad as long, bearing four pairs of setae, the anterior pair being discal and the others marginal. Anal plate small; anus situated near front margin of anal plate; anal setae large, subequal, the unpaired one situated at apex of anal plate. Legs very stout: posterior pair longest; each femur and patella of the first two pairs of legs with conspicuous dorsal spines; coxae large, without peglike spines. Length, 0.51 mm; width, 0.38 mm.

Male.—Sternoventral plate about twice as long as its greatest width, width at sternal region equal to width at abdominal region, narrowest between the posterior coxae. Movable chela of chelicerae

a long bladeliike structure, grooved and ending in a spurlike process; fixed chela absent. Length, 0.45 mm; width, 0.3 mm.

Type host.—*Microtus californicus*.

Type locality.—Los Angeles, Calif.

Type slide.—U.S.N.M. no. 1075.

Remarks.—Description based on three females and two males from type host, a meadow mouse, at the type locality, April 1926 (U.S. Public Health Service), and three females from a young *Microtus* sp., Flat, Alaska, March 29, 1925, by A. H. Twitchell.

Genus CERATONYSSUS Ewing, 1923

Body much longer than broad and sparsely clothed with short setae. Dorsal plate of female divided, posterior part large, not circular. Chelicerae shearlike, adapted for piercing. First segment of palpus of female with a hornlike process. Sternal plate broader than long, with three pairs of setae; genitoventral plate small, with indefinite anterior margin and a single pair of setae; anal plate broadly rounded in front, with two anterior, paired setae and one posterior, unpaired seta. Legs somewhat stout, second pair but slightly, if at all, enlarged; one or more spines on all coxae, except those of first pair.

Type species.—*Dermanyssus musculi* Koch, 1836.

Remarks.—This genus is nearest *Ophionyssus* Mégnin, 1884, but differs from Mégnin's genus in having a large posterior section of the dorsal plate and three pairs of setae on the sternal plate instead of two.

CERATONYSSUS OCCIDENTALIS, new species

PLATE 3, FIGURE 5; PLATE 4, FIGURE 1

Anterior dorsal plate about as long as, but much broader than, posterior one, subtriangular, and bearing about 20 setae; posterior dorsal plate broadest in front, pointed posteriorly, and bearing about 25 setae. Chelicerae very slender; movable chela stouter and shorter than the fixed one, which is very slender. Sternal plate much broader than long, poorly sclerotized except for a heavy, arched band along the posterior margin; anterior corners acuminate; front pair of sternal setae marginal, last pair situated at apices of posterior angles. Endopodal plates absent; endopodal setae longer than sternal setae. Genitoventral plate reduced, angulate, its single pair of setae submarginal. Anal plate egg-shaped in outline; anus near front margin; paired anal setae situated opposite center of anus, unpaired seta situated about two thirds the distance from anus to apex of anal plate. Legs moderate in length; posterior pair long-

est; coxae large, all but those of first pair bearing at least one spine. Length of female, 0.77 mm; width, 0.46 mm.

Type host.—Bat, (?) *Myotis* sp.

Type locality.—Adel, Oreg.

Type slides.—U.S.N.M. no. 1076.

Remarks.—Described from four females mounted on two slides, taken from "common brown bat" at the type locality, August 19, 1930, by Rosaline R. Walker (Bishopp no. 14849).

Subfamily DERMANYSSINAE

Genus DERMANYSSUS Dugès, 1834

Body stout, integument leathery and capable of much distension. Chelicerae of female very long and needlelike, chelae absent; chelicerae of male modified. Palpi simple, without spines or processes. Dorsal plate of female large, entire, frequently poorly sclerotized. Anal plate broadest near its anterior border, not egg-shaped in outline, with an anterior pair of setae and a posterior unpaired seta; anal opening not circular, situated in posterior part of anal plate. Legs rather slender, second pair never greatly enlarged.

Type species.—*Acarus gallinae* DeGeer (1778).

Remarks.—*Dermanyssus* Dugès and *Allodermanyssus* Ewing, 1923, are the only genera in the subfamily Dermanyssinae. *Dermanyssus* differs from *Allodermanyssus* in that the dorsal plate of the female is entire and the anal plate is not egg-shaped in outline and has the opening in the posterior part.

DERMANYSSUS EVOTOMYDIS, new species

PLATE 4, FIGURE 2

Body shape and texture of skin typical of the genus. Peritreme extending forward slightly beyond the second coxae. Palpi stout, not surpassing the front femora. Chelicerae very slender, but at the tip of each there is a slight swelling with a few minute teeth laterally. Sternal plate over three times as broad as long, arched. Genito-ventral plate about twice as long as broad, very slightly broadened posteriorly. Anal plate slightly longer than broad, of a shape typical of the genus; anal opening over twice as long as broad, situated about half its longest diameter from posterior margin of anal plate. Legs rather slender; first and last pairs subequal and slightly longer than the others. Length of female, 0.86 mm; width, 0.62 mm.

Type host.—*Evotomys* sp.

Type locality.—Mount McIntyre, N.Y.

Type (holotype) slide.—U.S.N.M. no. 1077.

Remarks.—Described from a female taken from the type host, a red-backed mouse, at the type locality, by Francis Harper, July 25, 1925. This species differs from our other known American species of *Dermanyssus* in having the chelicerae inflated and toothed at their apices.

DERMANYSSUS PROGNEPHILUS, new species

PLATE 4, FIGURE 3

Similar in appearance to the common chicken mite, *Dermanyssus gallinae* (DeGeer). Peritremes extending forward to opposite the first pair of coxae. Palpi reaching to slightly beyond the middle of first patellae. Chelicerae exceedingly long and slender, when fully extended reaching to the middle of the first tarsi, not broadened or toothed distally. Sternal plate poorly sclerotized, constituting a transverse arched band. Anal plate longer than broad, almost egg-shaped in outline; anal opening twice as long as broad and situated a little over one half of its greatest diameter from the posterior border; paired anal setae situated slightly in front of a transverse line drawn through middle of anus; unpaired seta similar to paired ones and situated halfway between posterior border of anus and posterior border of anal plate. First and last pairs of legs of about the same length and longer than the others. Length of female, 0.82 mm; width, 0.42 mm.

Type host.—*Progne subis*.

Type locality.—Bell, Md.

Type slide.—U.S.N.M. no. 1078.

Remarks.—Described from two females, which formed part of a lot of five individuals (two at least being nymphs) taken from the nest of type host, the purple martin, at the type locality by W. L. McAtee, September 23, 1926. This species is near *Dermanyssus gallinae* (DeGeer) but has longer peritremes and a differently shaped anal plate.

Subfamily RHINONYSSINAE

SOMMATERICOLA Trägårdh, 1904

Body very stout; integument leathery. Chelicerae rather stout, of the piercing type, teeth absent, movable chela clawlike. Palpi very short and stout, provided with a few spines. Spiracles situated dorsally. No dorsal plate present. Legs exceedingly short and stout, subequal; tarsal claws small, subequal; coxae stout, without spines.

Type species.—*Sommatericola levinseni* Trägårdh, 1904.

Remarks.—Females of *Sommatericola* have the same type of chelicerae as those of the monkey-infesting genus *Pneumonyssus* De

Haan and Grijns, 1901. However, *Sommatericola* is more closely related to the bird-infesting genera *Rhinonyssus* Trouessart, 1894, and *Sternostomum* Berlese, 1889, from which it differs in the absence of the dorsal plate.

SOMMATERICOLA ORIENTALIS, new species

PLATE 4, FIGURE 4

Body naked, almost twice as long as broad. First segment of palpus very long, as long as the other four segments taken together and largely united to cephalic cone. Cephalic cone reaching to middle of third segments of palpi. Chelicerae stout for the genus; movable chela long, curved; fixed chela not in a position for proper observation. Sternal region without plate; sternal setae six, subequal, arranged in two diverging rows. Anal plate small, broadly rounded in front; anus small, situated centrally; anal setae small. Legs stout, almost subequal, the first and last pairs slightly longer than the others. Tarsal claws large, strongly curved, and very sharp. Length of female, 0.75 mm; width, 0.44 mm.

Type host.—*Lanius nigriceps longicaudatus*.

Type locality.—Bangkok, Siam.

Type (holotype) slide.—U.S.N.M. no. 1079.

Remarks.—Described from a female specimen taken from skin of host, a shrike (U.S.N.M. no. 308292), which was collected at the type locality in 1926.

Family UROPODIDAE

CYCLACARUS, new genus

Nymphal characters as follows: Body a flattened disk with mouth parts concealed from above. Chelicerae chelate, of generalized type. Palpi short, filiform. Stigmata very large and situated in very heavily sclerotized peritremes on lateral margins of the body in front of first pair of coxae. Sternal plate occupying sternal area between coxae of last three pairs of legs, with a pair of pores. Anal plate very large, broader than long, with a small anal opening and two pairs of setae. Legs slender, porrect, with large, diverging, subequal, sharp claws; first pair of legs enclosed in eamerostome.

Type species.—*Cyclacarus aberrans*, new species.

Remarks.—The nymphal specimens upon which the type species of this genus is based are exceedingly unusual in having such large stigmata and peritremes and in having the same situated so far forward, in the position of the legs, and finally in the habitat they occupied on the tail feathers of a chimney swift.

CYCLACARUS ABERRANS, new species

PLATE 4, FIGURES 5, 6

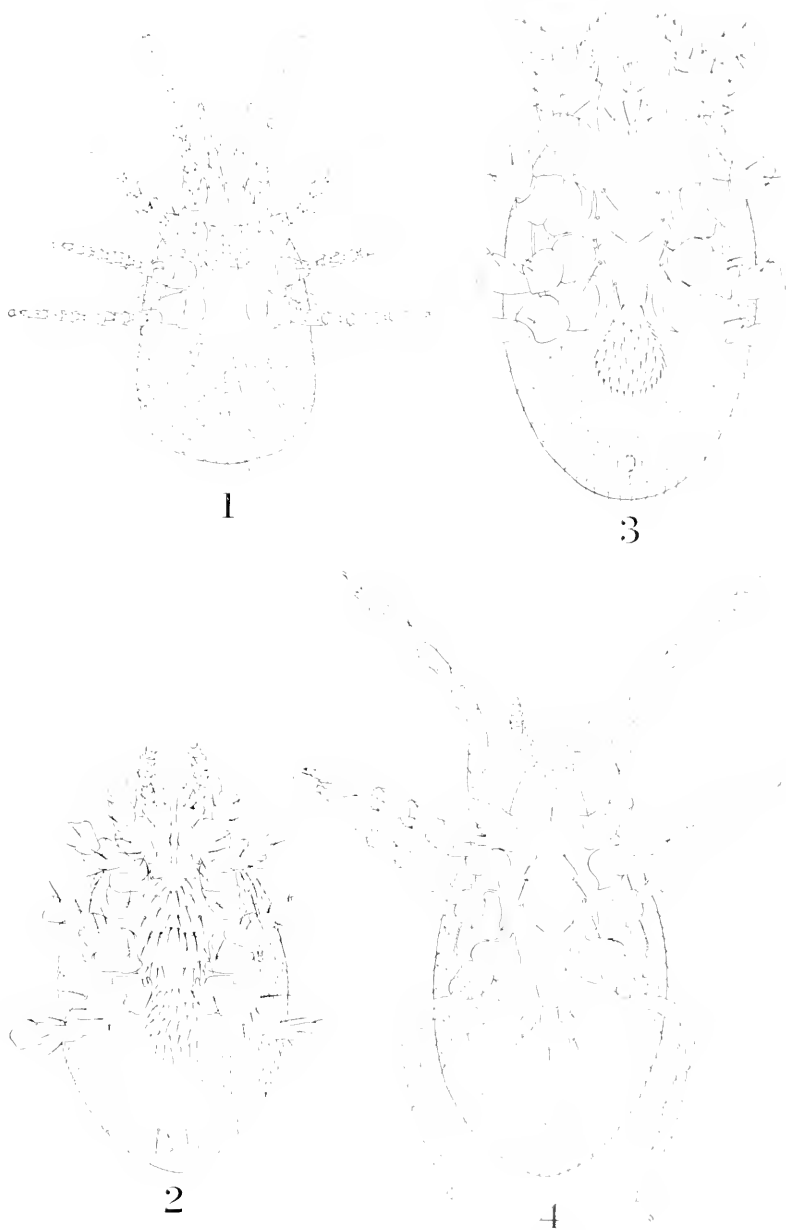
Body a large, flat disk provided with only a few minute setae. Epistome a fine, delicate, feathery process. Palpi short, simple, without processes or tubercles. Chelicerae very long, arising in posterior part of the body; chelae short; movable one curved and of a shape usual to the family; fixed one with two toothlike processes at the tip. Sternal plate large, twice as long as broad, occupying most of the sternal area and possessing a pair of pores situated a little behind the middle. Anal plate very large, angulate in front, broadly rounded behind, studded with the openings of integumentary pores, bearing a conspicuous pair of posterior, submarginal setae, and occupying most of the ventral surface of the abdomen. Metapodal plates very large, extending forward to in front of the third pair of coxae, thickly studded with pore openings. Peritremes exceedingly large and sclerotized and extending *backward* from each spiracle. Spiracles situated on lateral margins of body far forward, even *in front* of mouth parts. Legs slender; first pair smaller than the others and situated in the same opening as the mouth parts; tarsal claws long, curved, divergent, and very sharp. Length of nymph, 1.49 mm; width, 1.33 mm.

Type host.—*Chaetura pelagica*.

Type locality.—West Chester, Pa.

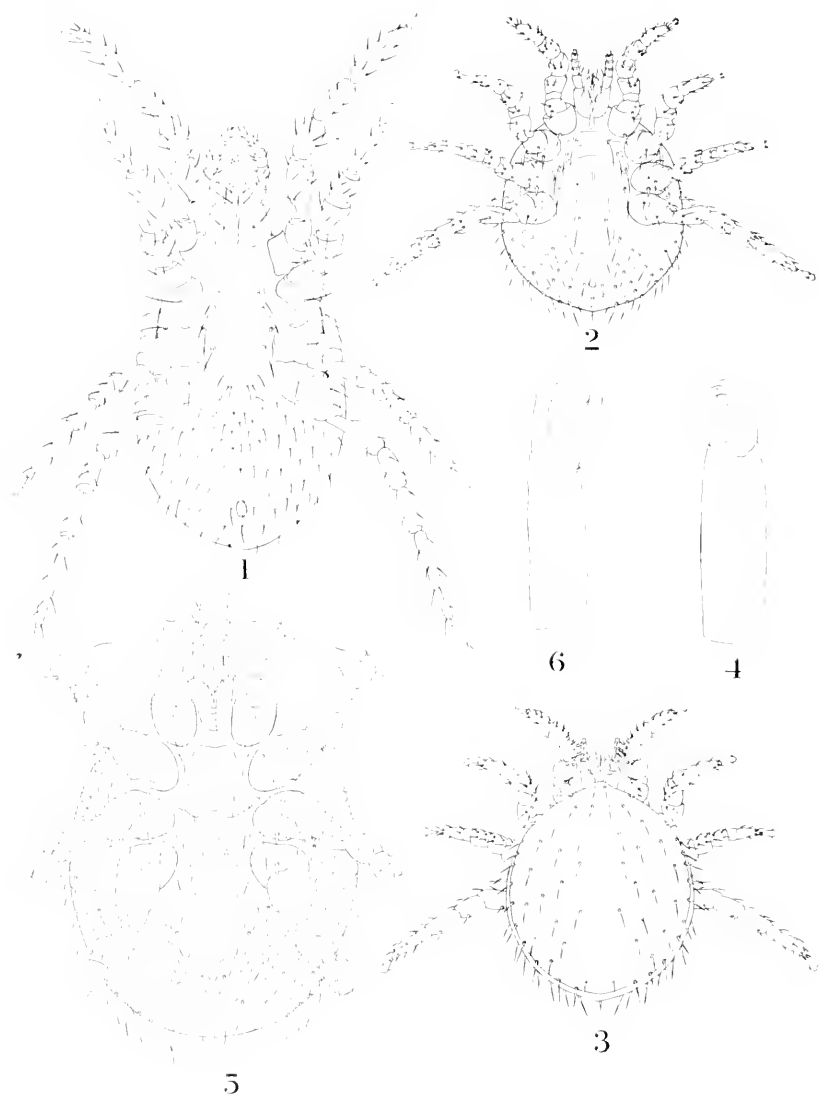
Type (holotype) slide.—U.S.N.M. no. 1080.

Remarks.—Described from four nymphs taken as follows: One (holotype) from tail feather of type host, a chimney swift, collected at the type locality by D. Smiley, May 22, 1930 (Bishopp no. 18529); and three nymphs collected from the same host at the type locality by the same collector, May 4, 1930 (Bishopp no. 13905). This mite is not only remarkable for the situation in which it was taken (on the tail feathers of a swift), but its morphology is unusual in certain respects, particularly in the nature and position of the peritremes and in the presence of so many and such conspicuous integumentary pores.



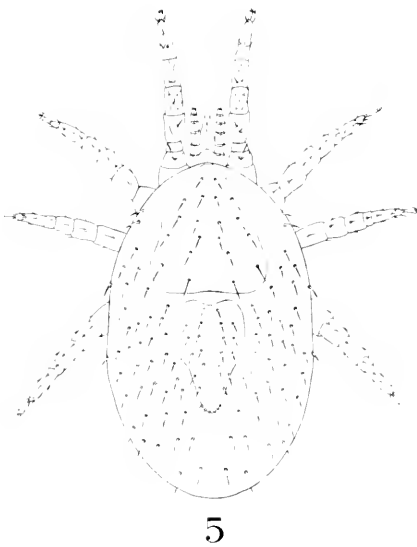
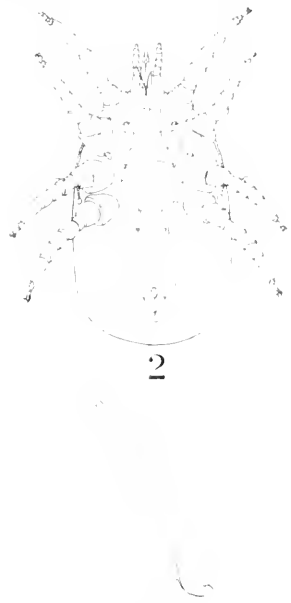
NEW SPECIES OF PARASITIC MITES

1, *Acanthochela chilensis*, ventral view. 2, *Thysanopneustes streptidis*, ventral view of body. 3, *Eubucnema-
 musus onychomydis*, ventral view of body. 4, *E. utahensis*, ventral view. (Drawn by Eleanor A. Carlin
 and Mrs. Katherine Munroe.)



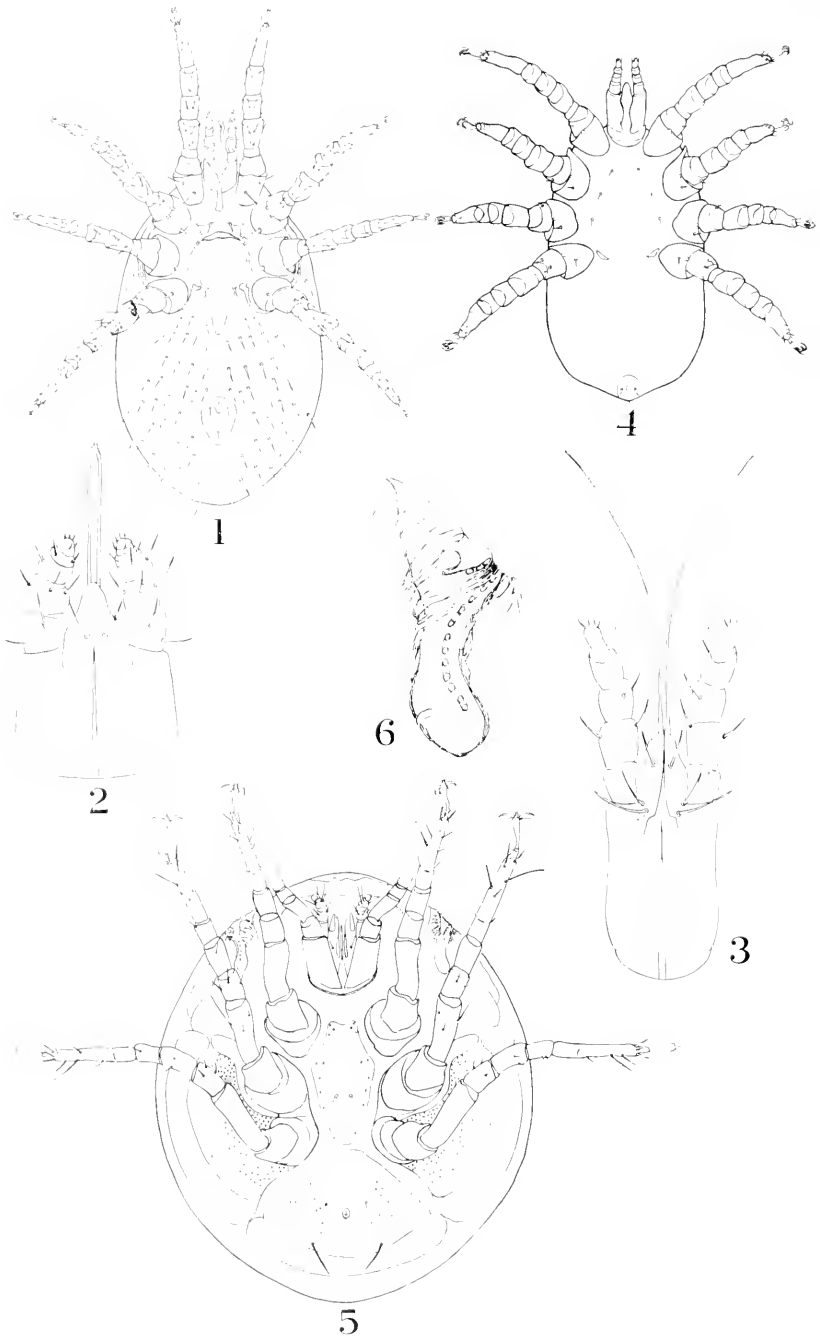
NEW SPECIES OF PARASITIC MITES.

1, *Euhaemogamasus oregonensis*, ventral view. 2, *Cyctolaclaps circularis*, ventral view. 3, *C. circularis*, dorsal view. 4, *C. circularis*, side view of chelicera. 5, *Macrolaelaps peruvianus*, ventral view of body. 6, *M. peruvianus*, side view of chelicera. (Drawings by Eleanor A. Carlin and Mrs. Katherine Munroe.)



NEW SPECIES OF PARASITIC MITES

1, *Hemitaclaps americanus*, ventral view of cephalothoracic region. 2, *H. americanus*, ventral view. 3, *Tetranychus gonysus microti*, ventral view. 4, *T. microti*, chelicera of male. 5, *Tetranychus gonysus microti*, ventral view. (Drawings by Eleanor A. Carlin and Mrs. Katherine Minnie)



NEW SPECIES OF PARASITIC MITES.

1, *Dermanyssus occidentalis*, ventral view. 2, *Dermanyssus erotomydis*, ventral view of mouth parts. 3, *D. proleptophlois*, ventral view of mouth parts. 4, *Sommatricicola orientalis*, ventral view. 5, *Cyclacarus aberrans*, ventral view. 6, *C. aberrans*, detail view of peritreme. (Drawings by Eleanor A. Carlin and Mrs. Katherine Munroe.)

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